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KIRKPATRICK (T. W.). **Insect Pests of Cacao and Insect Vectors of Cacao Virus Disease.**—*Rep. Cacao Res. Trinidad 1945–51* pp. 122–125, 5 refs. St. Augustine, Trinidad, 1953.

Much of the information in this review of research on the virus disease that attacks cacao in Trinidad and its vectors has already been noticed from other sources [*R.A.E.*, A **38** 309, etc.]. The disease has recently extended its range towards the east [*cf.* **37** 70] and was well established in 1951 at a place near the east coast. *Pseudococcus comstocki* (Kuw.) is included as a vector in addition to the mealybugs previously recorded [**38** 310]. *Planococcus* (*Pseudococcus*) *citri* (Risso) is the commonest and most mobile of all five, and the young adult females of this species are responsible for most of the natural spread. In experiments on transmission in which infected examples of *P. citri* fed on cacao beans [*cf.* **38** 310], a feeding period of at least six hours was found advisable, as the mealybugs do not feed immediately after transference. When single mealybugs were used, the infection rate among the test plants appeared to be 24 per cent., but was probably higher, since some that showed no symptoms were subsequently found to be infected. The latent period of the virus in young growing plants infected by mealybugs was 40–178 days.

P. citri feeds on many plants in Trinidad, but has not been found on *Citrus* there. On cacao, it feeds preferably on the unripe pods, especially in the grooves on them, but small colonies occur commonly on the flower cushions, and the leaves and stems of the chupons are often severely infested. A large well-fed female deposits about 300 eggs over a period of 7–10 days. Most of the crawlers hatch in 4–5 days, and they can survive without feeding for 48 hours, during which they may wander considerable distances. The development of the females, from egg to egg, lasts a minimum of 25 days, and that of the males, from egg to adult emergence, about 20 days. The females are fertilised 5–6 days after becoming adult and oviposit after a further four days; the sexes are equal in numbers, and parthenogenesis does not occur. Large colonies are usually attended by ants, but these have not been observed transporting the mealybugs or defending them from natural enemies, which afford considerable control. The predators present comprise *Scymnus* sp. and, to a less extent *Hyperaspis jucunda* (Muls.) and another species of the same genus; the larvae of an unidentified Cecidomyiid, which are invariably present, and often abundant, in large colonies, where they destroy the eggs; and larvae of the Syrphid, *Baccha stenogaster* Will., and of Chrysopids. The only primary parasite of *P. citri* in Trinidad is *Leptomastix dactylopii* How. [**42** 44], which has not been reared from any other mealybug on cacao.

The eggs of this Encyrtid are laid singly in the adults or sometimes in the third-instar nymphs, and the adults emerge after 13–18 days. They pair immediately, and oviposition begins after a few hours and continues for 14 days, the females parasitising an average of ten mealybugs each per day. Unfertilised females readily oviposit, giving rise to males. *L. dactylopii* is itself commonly parasitised by *Gahaniella* sp., two species of *Achrysopophagus*, and *Coccidoctonus trinidadensis* (Crwf.), and the last of these Encyrtids also attacks the Cecidomyiid predator. Several Signiphorids are secondary or tertiary parasites of *P. citri*. *L. dactylopii* was reared from 11 per cent. of the parasitised examples of *P. citri* collected during 1949, and hyperparasites from the remainder; the latter emerged from the greatest proportion (96 per cent.) of the mealybugs in January and the smallest proportion (85 per cent.) in May. A severe infestation of *P. citri* on cacao in a greenhouse was almost completely controlled in about three months following the accidental introduction of *L. dactylopii* without hyperparasites.

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Distribution Maps of Insect Pests.—Series A, nos. 43–48; 13 (revd.). London, Commonw. Inst. Ent., 1954.

These maps belong to a series already noticed [*R.A.E.*, A **40** 203; **42** 193]. Nos. 43–48 deal, respectively, with *Planococcus citri* (Risso), *Macrosiphum solanifolii* (Ashm.), *Myzus persicae* (Sulz.), *Epilachna varivestis* Muls., *Conotrachelus nenuphar* (Hbst.) and *Rhagoletis pomonella* (Walsh), and no. 13 (revised) with *Platyedra gossypiella* (Saund.).

Marcovitch (S.). **The Insect Pest Situation in Israeli Agriculture.**—*J. econ. Ent.* **47** no. 1 pp. 19–23, 4 refs. Menasha, Wis., 1954.

The following is substantially the author's summary. *Citrus* is the major export crop in Israel, and the most important of the pests that attack it are *Chrysomphalus ficus* Ashm. (*aonidum*, auct.), *Phyllocoptruta oleivora* (Ashm.) and *Ceratitis capitata* (Wied.). Field tests on the last showed good control with sprays of dieldrin and lindane [γ BHC], and fruits for export are fumigated with ethylene dibromide against the larvae.

Lixus juncii Boh. is a serious pest of sugar-beet [*cf.* *R.A.E.*, A **41** 216], and emulsion sprays of parathion gave promising control in preliminary tests. Other important pests are *Dacus oleae* (Gmel.) on olive [*cf.* **41** 383], *Prodenia litura* (F.) and *Earias insulana* (Boisd.) on cotton, *Lobesia* (*Polychrosis*) *botrana* (Schiff.) and *Planococcus* (*Pseudococcus*) *citri* (Risso) on vines, *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple, species of *Capnodis* on stone fruits, and *Vespa orientalis* L., which injures various fruits and young trees [*cf.* **41** 216].

Klostermeyer (E. C.). **Mite Control on Legume Seed Crops.**—*J. econ. Ent.* **47** no. 1 pp. 30–34, 4 refs. Menasha, Wis., 1954.

An account is given of further investigations on the control of *Tetranychus bimaculatus* Harvey and *T. atlanticus* McG. on seed crops of lucerne and red clover in Washington [*cf.* *R.A.E.*, A **39** 278]. In 1951, red clover was treated with 20 lb. 10 per cent. DDT dust per acre on 2nd July for the control of *Lygus* and with acaricidal dusts or sprays on 18th July and 2nd August, dusts being applied at about 35 lb. and sprays at 25 U.S. gals. per acre. Periodic counts of mites on sample leaflets showed that Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite], applied at 1·8 lb. per acre in a 3 per cent. dust or an emulsion spray, demeton [diethyl 2-(ethylmercapto)ethyl thiophosphate], at 0·6 lb. per acre in an emulsion spray, and Ovotran (p-chlorophenyl p-chlorobenzenesulphonate), at 4 lb. per acre in a wettable-powder spray, gave good control for five weeks, after which the growth of the clover provided abundant untreated foliage and populations increased. Ovotran at lower rates in spray or dust, 2·5 lb. p-chlorophenyl phenyl sulphone, 0·75 lb. dinex (dicyclohexylamine), 0·4 lb. methyl-parathion or 30 lb. sulphur per acre in dusts and 2·25 lb. 2,4-dichlorophenyl benzenesulphonate, 0·3 lb. Metacide (a mixture of parathion and methyl-parathion) or 1·1 lb. schradan per acre in emulsion sprays did not prevent continuous increase of the mite. Predator populations were low on plots treated with demeton, Metacide, methyl-parathion, sulphur and schradan and high on that dusted with Aramite.

In 1952, lucerne was sprayed with DDT or toxaphene alone on 30th June against *Lygus* and with 7 lb. toxaphene or 2 lb. DDT with acaricide in 25 U.S. gals. spray per acre on 9th August; second applications of dinoseb (triethanolamine) and parathion were made a week later. Mite counts made at weekly intervals after spraying showed that plants sprayed with DDT and acaricide had higher populations than those treated with toxaphene and acaricide. Treatment with 1 lb. 36 per cent. dinoseb (triethanolamine) resulted in the lowest mite population, possibly because it caused severe scorching of the leaves. Aramite at 2 lb. per acre suppressed the mites throughout the six weeks of observation, 0·25 lb. demeton, 2 lb. DMC (1,1-bis(p-chlorophenyl)ethanol) and 2 lb. Chlorobenzilate (2,2-bis(p-chlorophenyl)-2-hydroxyethyl acetate) gave good control, though populations were showing an increase at the end of six weeks, and 0·25 lb. parathion was effective for rather less time. Numbers declined on plots treated with 3 lb. Ovotran, but were higher than those on other plots. An adjacent area not sprayed with insecticide or acaricide had a lower mite population than any of the treated plots, and plots sprayed with toxaphene or DDT only showed 46 and 34 times as many mites, respectively, as those treated with these materials and Aramite. Observations on predators and other insects a week after the applications of insecticide and acaricide indicated that Anthocorids were somewhat reduced by the toxaphene treatments and severely reduced by DDT with parathion, spiders were reduced by parathion, and Coccinellids and the pea Aphid [*Macrosiphum pisum* (Harris)] by toxaphene. A month after treatment, Anthocorids were still fewer in number on the toxaphene plots.

Dusts and sprays of Aramite gave consistently good control over three years of tests and good control when applied by a variety of methods, including aerial spraying and dusting, by farmers. They are relatively non-toxic to pollinators and predators. Demeton was more effective than schradan, but would have to be applied repeatedly or at dosages above 0·25 lb. per acre for adequate residual control. Chlorobenzilate and DMC showed no adverse effects and are considered promising.

DOUTT (R. L.). **An Evaluation of some natural Enemies of the Olive Scale.**—*J. econ. Ent.* **47** no. 1 pp. 39–43, 4 graphs, 2 refs. Menasha, Wis., 1954.

In 1951, *Parlatoria oleae* (Colv.) was known to be present in California from San Diego County in the south to Glenn County in the northern Sacramento Valley [*cf. R.A.E.*, A **38** 284] and to attack 211 species of plants, including olive, apple, pear and stone fruits. A search was begun for natural enemies of the scale in other parts of the world, including some in which it is indigenous, and 63 samples were received from India, Pakistan, Afghanistan, Persia, Iraq, Syria, Egypt, Lebanon, Cyprus, Israel, Greece and Spain. Rearing and testing in quarantine showed that Aphelinids of the genus *Aphytis* are the dominant natural enemies of *P. oleae* in its native range, and the most effective appeared to belong to a complex of sibling species morphologically indistinguishable from *A. maculicornis* (Masi), but differing biologically among themselves and from a form already present in California. Those obtained from India, Pakistan and Afghanistan, Persia and Iraq, and Spain are referred to as Indian, Persian and Spanish *Aphytis*, respectively. A species of *Aphytis* near *A. proclia* (Wlk.) from *Parlatoreopsis* sp. in Egypt (Egyptian *Aphytis*) also attacked *Parlatoria oleae*, but proved ineffective in field tests. Shipments from Persia included a species of *Aspidiotiphagus* near *citrinus* (Craw), which was liberated in large numbers but recovered only in urban areas, possibly because suitable habitats were not available in commercial orchards. The predacious Coccinellid, *Chilocorus bipustulatus* (L.), from Israel, was liberated in the spring of 1952 and has continued to reproduce in moderate numbers; its action will probably supplement that of the indigenous *C. stigma* Say, which is common but usually ineffective against *P. oleae*. A species of *Cybocephalus* from Spain was also released but has not been recovered in the field.

The most promising natural enemy is the Persian *Aphytis*, which greatly reduced the scale population in several test plots of olive, and details are given of the seasonal cycle of the scale and this parasite. Parasitism increased sharply in April and May, when development was rapid and the host population consisted almost entirely of mature females, the preferred stage, but then declined and was not high even when females of the summer generation were available. A high density of *P. oleae* appears to increase the probability of survival of the crawlers, and the reduction of dense populations by the parasite may expose the young stages to greater mortality.

HILLS (O. A.) & TAYLOR (E. A.). **Effect of Curly Top-infective Beet Leafhoppers on Cantaloup Plants in varying Stages of Development.** —*J. econ. Ent.* **47** no. 1 pp. 44–48, 1 graph, 3 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. Further experiments were carried out at Phoenix, Arizona, in 1949–51 to determine the effect of infesting cantaloupe-melon plants in various stages of development with examples of *Circulifer tenellus* (Baker) (beet leafhopper) infected with the curly-top virus [*cf. R.A.E.*, A **38** 357]. In one experiment in which seedlings were infested with leafhoppers from colonies carrying different strains of the virus, one strain caused more damage than two others.

The earlier the stage at which the plants were infested, the more severely were they damaged. A large proportion of the plants infested in the cotyledon and two-leaf stages were killed. Plants in the four-leaf stage survived, but were stunted and the yield was reduced. Plants in the six-leaf stage and those having an average runner length of eight inches were less damaged, but still showed retardation in growth and reduction in yield. The quality of some of the fruits was reduced, as shown by a reduction in the content of total soluble solids in the juice.

The increase in resistance in older plants may account for the fact that cantaloupe melons can be grown in areas in which other cucurbits are killed by the curly-top virus, but it does not follow that the crop may not suffer loss from the disease. The results indicated that severe damage can result from leafhopper migration before the plants reach the six-leaf stage, and since retardation of growth and reduction in yield may occur without the production of recognisable symptoms, the disease may be responsible for reductions in yield not ordinarily attributed to it.

REA (J. M.), HAMNER (A. L.) & HUTCHINS (R. E.). **Some Effects of Aldrin, BHC-DDT, Dieldrin, and Toxaphene on the Boll Weevil.**—*J. econ. Ent.* **47** no. 1 pp. 48–53, 3 refs. Menasha, Wis., 1954.

The following is based on the authors' introduction and conclusions. Current recommendations for the control of *Anthonomus grandis* Boh. on cotton in the United States show that at least four organic insecticides are recognised as being about equally effective in producing increases in the yield of seed cotton, and experiments were therefore undertaken with dusts and sprays to determine the rapidity of action of aldrin, dieldrin, toxaphene and a mixture of BHC, DDT and sulphur at recommended rates against the adult weevils, the effect of rainfall on toxicity, and the effect of lethal deposits of toxaphene on the feeding and oviposition of the females. The plants were treated in the laboratory and then caged in the open, and field-collected weevils were released in the cages. The results indicated that toxaphene and dieldrin gave appreciably higher mortality in five days than aldrin or the mixture of BHC and DDT, toxaphene being the best of all, and that all materials were more effective in dusts than in sprays.

Half an inch of simulated rainfall significantly reduced control by all insecticides [*cf. R.A.E.*, A **41** 363] in either sprays or dusts, except in the case of dieldrin applied as a spray, and dieldrin and toxaphene then gave almost the same mortality in five days. The effect of rainfall on dusts containing 20 per cent. toxaphene and 30 per cent. Attaclay [attapulgite] varied with the other ingredients, the reduction being greater for talc, kaolin, and a mixture of sulphur and bentonite than for Pyrax [pyrophyllite]. The egg-laying and feeding activities of the females were reduced by exposure for only two hours to lethal deposits of toxaphene in a dust or spray.

BARNES (M. M.), GAMMON (C.) & ROBINSON (D. W.). **Insecticide Dusts for Control of the Western Grape Leaf Skeletonizer in California.**—*J. econ. Ent.* **47** no. 1 pp. 54–57, 4 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. Investigations in 1946–48 on the control of *Harrisina brillians* B. & McD. on grapes in California [*cf. R.A.E.*, A **34** 112] showed that although a 5 or 10 per cent. DDT dust would give commercial control of the Zygaenid, a 50 per cent. cryolite dust would apparently be more satisfactory for general use [*cf.* **36** 397], since it gave very good ultimate mortality, retained its toxicity well and would be less likely to interfere with potential natural enemies. If significant proportions of nearly full-fed larvae are present, however, DDT should be applied, since the larvae might not all acquire a lethal dose of cryolite. Increasing the cryolite concentration above 50 per cent. appeared to give little improvement in mortality. In tests of other dusts in 1948, p,p′methoxy-DDT (methoxychlor) and DDD (TDE) gave promising control and may be worth testing where cryolite or DDT would involve a residue hazard, but parathion and methyl-DDT (ditolyl trichloroethane) were ineffective.

BARNES (M. M.), ROBINSON (D. W.) & FORBES (A. G.). **Attractants for Moths of the Western Grape Leaf Skeletonizer.**—*J. econ. Ent.* **47** no. 1 pp. 58–63, 5 refs. Menasha, Wis., 1954.

The following is based on the authors' introduction and summary. In surveys to determine the effectiveness of restrictive procedures against *Harrisina brillians* B. & McD. on grapes in and along the borders of the part of California known to be infested [*cf. R.A.E.*, A **36** 397, etc.], detection of the presence of the Zygaenid in peripheral areas has depended on seeing skeletonised foliage or the moths themselves. The development of an effective attractant for the latter would materially increase the efficiency of the survey, and more than 50 materials, including fermenting baits, essential oils, components of essential oils and related materials, ethyl esters of aliphatic acids, a compound known to be present in grapes, and extracts obtained from the female moths, were therefore tested in the field in 1947–50.

A benzene extract of the females proved highly attractive to the males and resulted in much higher total trap catches than any other material. Each trap was baited with extract from two females, and though this ceased to be attractive after 36–48 hours, it may be possible to extend the period of attractiveness by increasing the amount per trap or by varying the extract formulation. Of the other materials, methyl anthranilate appeared to be the most attractive, followed by anisaldehyde and oenanthic ether, all of which attracted both sexes. Ethyl palmitate was a good attractant for the females, but as catches with this material were highest 10–15 days after the installation of the traps, a decomposition product may be concerned.

Casida (J. E.), Chapman (R. K.), Stahmann (M. A.) & Allen (T. C.). **Metabolism of Schradan by Plants and Insects to a toxic Phosphoramide Oxide.**—*J. econ. Ent.* **47** no. 1 pp. 64–71, 3 figs., 32 refs. Menasha, Wis., 1954.

The following is based mainly on the authors' summary. It is known that schradan undergoes metabolic activation in plants [*cf. R.A.E.*, A **41** 71], insects and mammals, and recent investigations have shown that the metabolite formed in mammals is the monophosphoramide oxide of schradan. In this paper, the authors show that the same metabolite is produced in plants and in insects. Three methods of analysis for the metabolite are described, based on enzymatic inhibition of cholinesterase or chymotrypsin and colorimetric analysis based on formaldehyde liberated on degradation, and the chemical reactions involved in the metabolism and colorimetric analysis are shown. The danger to health represented by the metabolite in plants was experimentally evaluated and shown to be relatively less significant than that of the residual schradan itself, since the metabolite is unstable and easily destroyed, giving rise to less toxic products, and its production in plants is slow and dependent on a reservoir of schradan, whereas schradan is rapidly converted in mammals to this same metabolite. The selective toxicity of schradan to insects is due to several causes, including variation in their ability to metabolise schradan and differences in sensitivity of the insect cholinesterase to this anticholinesterase agent. The tissues in the digestive system of *Periplaneta americana* (L.) found most active in metabolising schradan were the gastric caecae. The toxic effect on insects would appear to be a resultant of oxidation in the plant and in the insects themselves.

Glick (P. A.) & Hollingsworth (J. P.). **Response of the Pink Bollworm Moth to certain Ultraviolet and Visible Radiation.**—*J. econ. Ent.* **47** no. 1 pp. 81–86, 3 figs., 13 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. Mercury-vapour and ultra-violet fluorescent lamps were tested in specially designed insect traps for their attractiveness to adults of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) in 1952. The traps were operated from 27th March to the end of the year in the San Benito area of the Lower Rio Grande Valley and from August or later in other parts of Texas and in Louisiana and Mississippi. About 50,000 adults were collected in a mercury-vapour trap and about 112,000 in an ultra-violet trap in a single night in the San Benito area, and the ultra-violet traps were in general the more attractive. Single adults were taken in mercury-vapour traps in Lamar and Fannin Counties in

Texas, which were previously thought to be free from infestation, and one was collected in a mercury-vapour trap operated in a cottonseed warehouse in Lamesa, Texas, in October 1952. Uses to which the traps might be put are reviewed.

BALLARD (R. C.) & DAVIDSON (R. H.). **Control of Mites in Clothes Moth Cultures.**—*J. econ. Ent.* **47** no. 1 p. 93. Menasha, Wis., 1954.

Cultures of *Tineola bisselliella* (Humm.), used for insecticide evaluation at the Ohio State University, have frequently been reduced by a predacious mite. In the rearing technique adopted, the moths oviposit on a piece of cat's fur 4 × 8 ins. in size, and the eggs are brushed off on to wool strips. The mites mostly occurred on the fur and destroyed the eggs. Dusting the fur with 0·5 gm. 10 per cent. Ovotran (p-chlorophenyl p-chlorobenzene-sulphonate), rubbed in with a camel's-hair brush, caused a gradual reduction in the mites, which disappeared after about four weeks. Reinfestation occurred and was controlled by additional applications of the dust. Frequent and continued use of the acaricide reduced oviposition by *Tineola*, but as only 1–2 treatments are usually necessary, the effect on the moth is of little consequence.

HOWE (R. G.) & DAVIS (A. C.). **Corn Earworm Control on Long Island.**—*J. econ. Ent.* **47** no. 1 pp. 94–97, 1 ref. Menasha, Wis., 1954.

Heliothis armigera (Hb.) is the most injurious pest of sweet maize on Long Island, New York. Infestation increases as the season progresses, and the application of insecticides is necessary in August and September. In tests of dusts applied with power equipment, four applications of 5 per cent. DDT or 1 per cent. parathion at three-day intervals, or five of the DDT dust at two-day intervals, beginning on 4th August 1951, when 70 per cent. of the ears showed silks, and all at 50 lb. per acre, gave good and nearly equal reductions in infested ears. In 1952, under wet, cold conditions, treatment with 5 per cent. DDT or 2 per cent. isodrin [*cf. R.A.E.*, A **41** 268, note] on 27th and 29th August and 1st September gave relatively poor results, bad weather preventing further applications and the low temperatures prolonging the hatching period beyond the time when there was sufficient coverage of insecticides; treatment every 4–5 days until even withered silks had received 1–2 applications would have been necessary for adequate control.

In tests of sprays in 1951, 1–3 U.S. quarts 25 per cent. DDT emulsion concentrate or 1 U.S. quart of the concentrate with 10 U.S. quarts mineral oil in 25 U.S. gals. spray per acre, applied with a power sprayer at a pressure of 80 lb. per sq. in. three times at five-day intervals from 13th August, when 60 per cent. of the ears showed silks, gave poor reductions in infested ears, apparently because the spray interval was too long, the pressure and quantity of spray were too low, and the ears of the maize variety used were easy for the larvae to enter. Treatment with the same quantities of insecticide or with 10 U.S. quarts mineral oil alone in 35 U.S. gals. spray per acre with a hand sprayer on 24th August, when 50 per cent. of the ears showed silks, and again on 27th and 30th August and 3rd September, was as effective as treatment with the 5 per cent. DDT dust; mineral oil appeared to act as a penetrant and also as an adhesive during wet weather. To test the importance of each application in a schedule of three at three-day intervals, beginning when 50 per cent. of the ears showed silks, 1·4 U.S. quarts of the DDT concentrate in 35 U.S. gals. spray per acre was applied 1–3 times between 24th and 30th August. The results indicated that the application made on 27th August was the most important and that control was as good with the first two applications as with all three, but this finding would be affected by weather conditions.

In a preliminary test in 1952 on the effects of pressure, spray quantity and nozzle type, 3 U.S. quarts of the DDT concentrate in 24–60 U.S. gals. spray per acre was applied at pressures of 80–120 lb. per sq. in. four times from the date of 25 per cent. silking (2nd August). Better control was given by the higher rates of spray application, but differences in pressure or type of nozzle did not influence the results.

Applications of 1·5 U.S. pints emulsion concentrate containing 19 per cent. isodrin or endrin [*cf. loc. cit.*] in 50 U.S. gals. per acre were as effective as applications of 3 U.S. quarts of the DDT concentrate in 50 U.S. gals. in July, when infestation was low, but less so in August, when it was high and the weather wet. Under these conditions, the addition of 10 U.S. quarts mineral oil improved the control given by DDT.

Barnes (D. F.) & Reilly (G. W.). **Hatching of Indian-Meal Moth Eggs in Glycerine.**—*J. econ. Ent.* **47** no. 1 p. 97. Menasha, Wis., 1954.

In July 1951, open dishes of glycerol, exposed in a prune warehouse in California to accumulate samples of air-borne materials, were found to contain young Pyralid larvae that had hatched from eggs deposited by moths caught in the glycerol. When newly laid eggs of *Plodia interpunctella* (Hb.) were put in dishes containing glycerol and kept at room temperature, a few hatched and others contained visible larvae within the shell after about five days. Eggs scattered on the surface of a mixture of glycerol and water (1:1) remained suspended just beneath the surface, and a few hatched or contained fully developed larvae after six days, whereas eggs scattered on water alone sank immediately and showed no development. In general, about 1·5–2 per cent. of the eggs hatched and 20–35 per cent. contained developed larvae in glycerol or glycerol and water; all the larvae that hatched were dead when found.

Boush (G. M.). **Mortalities of** *Sphenarium purpurascens* **Charp. (Acrididae) as related to Lengths of Exposure to some Insecticides.**—*J. econ. Ent.* **47** no. 1 pp. 100–102, 3 refs. Menasha, Wis., 1954.

Outbreaks of grasshoppers, mainly adults of *Sphenarium purpurascens* Charp., caused serious injury in the central and southern regions of Mexico during the late summer of 1952, and organic insecticides were tested for their control on maize in the silk stage. In the first test, endrin and isodrin [*cf. R.A.E.*, A **41** 268, note] were applied at rates of 36 and 43 U.S. gals. 0·5 per cent. spray per acre, respectively, and the other materials as dusts at 30–38 lb. per acre, and about 2·5 ins. rain fell three hours after application. Counts made 24 hours after treatment showed that dusts of 1 or 2·5 per cent. BHC, aldrin or dieldrin and the isodrin spray gave over 90 per cent. mortality, whereas the endrin spray and dusts of 0·5–1 per cent. parathion, 5–10 per cent. toxaphene or 2·5–5 per cent. chlordane gave poor results. On another day, when no rain followed application, all these materials but endrin and 0·5 per cent. parathion gave more than 90 per cent. mortality. It is concluded that materials that give satisfactory control under good conditions may not do so when the period of exposure is reduced.

In laboratory tests, adult females of *S. purpurascens* were provided with lucerne foliage and water and exposed for 30, 60, 120 or 180 minutes to dried residues on filter papers. Examination after 24 hours showed that 0·25 per cent. aldrin, 0·5 per cent. DDT or isodrin or 1 per cent. chlordane or toxaphene caused low mortalities and 0·25 per cent. BHC or parathion moderately high mortalities at the two shorter exposures, whereas aldrin gave very high mortality and all other materials but DDT relatively high mortality at the two longer ones. After the longest exposure, mortality was almost complete for aldrin, about 50 per cent. for DDT and about 80 per cent. for the other materials.

CRESSMAN (A. W.), BROADBENT (B. M.) & MUNGER (F.). **Concentrations of Oil and Parathion for Control of California Red Scale.**—*J. econ. Ent.* **47** no. 1 pp. 100–102, 3 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. In further tests on lemon trees in California in 1950–52 [*cf. R.A.E.*, A **39** 164], sprays of 1·8 per cent. medium emulsion oil with 0·5 lb. 25 per cent. wettable parathion per 100 U.S. gals. were more effective than 1 per cent. oil with the same amount of parathion against *Aonidiella aurantii* (Mask.) when thoroughly applied, whereas there was little difference between them when coverage was less uniform. Sprays of 1 per cent. oil with 1 lb. 25 per cent. parathion were as effective as those containing 1·8 per cent. oil with the same amount of parathion when a heavy application was made, and both were better than one of 1·8 per cent. oil with 0·5 lb. 25 per cent. parathion. In one grove, this last mixture gave better control of *Paratetranychus citri* (McG.) than 1 per cent. oil with 0·5 lb. 25 per cent. parathion.

GUTHRIE (F. E.). **Life History of *Hylemya lupini* (Coq.) in Florida.**—*J. econ. Ent.* **47** no. 1 pp. 103–107, 1 fig., 6 refs. Menasha, Wis., 1954.

Blue lupins, which are widely grown in winter as a green-manure crop in the coastal plains of the south-eastern United States, have been extensively injured since 1945 by larvae of *Hylemyia lupini* (Coq.), which has become the most important insect pest of the crop. This Anthomyiid is widely distributed in the south and west of the country and attacks several species of *Lupinus* and *Astragalus mollissimus*. Blue lupins sown in October make rapid growth during the autumn and winter and are ploughed under in February or harvested for seed in May. Plants that are attacked when young are sometimes killed, but those that are not usually outgrow the injury and produce about 75 per cent. of the normal green weight, though those that do not become well established before the onset of cold weather are severely affected. Infestation in spring is of little importance in reducing green weight. The loss of seed due to infestation is estimated at about 25 per cent. in Florida.

Investigations on the bionomics of *H. lupini* in Florida showed that the eggs are deposited in the terminal or lateral buds or sometimes on the leaf bracts, the stems or the junctions of the lateral stems with the main stalk, singly when the adult population is low and in groups of ten or more when it is high, and can be found at almost any stage of plant growth. The newly hatched larva feeds for a few hours on the bud and then bores into the stem, and there is usually only one larva per burrow, though 2–3 have sometimes been found. Injured buds become surrounded by upright adventitious stems. During the flowering stage, the larvae bore into the axis of the developing raceme, causing a reduction in seed yield, and late in the season they occasionally tunnel into the developing seed pods, causing them to rot and retarding seed development. Pupation occurs occasionally in the burrow, but usually in the ground near the plant at a depth of 0·5–6 ins. The adults are active and spend their life on or near the food-plants. They survived temperatures of 24°F. for 24 hours without appreciable loss of vigour and short exposures to over 90°F. without excessive mortality, but with reduced activity; the two sexes are equal in numbers. In special observations, the egg, larval and pupal stages lasted 2–4, nearly 14 and about 14 days, respectively, at favourable temperatures (about 70°F.). Adult males and females lived for averages of about 14 and 27 days, respectively, the preoviposition period lasted about a week and the numbers of eggs laid per female averaged 45. The eggs were usually laid during daylight and at the rate of 4–6 eggs per day.

Three complete generations and a partial fourth were observed on lupins during the crop season; the way in which the summer is passed is unknown. Adults were first seen in appreciable numbers in early autumn. Larvae of the next generation pupated in late October and early November, and a few of the pupae gave rise to adults that produced a further generation of larvae during winter. The rest of the pupae overwintered. Adults emerged in late January and early February, and those of two further generations in March and in late May, respectively. Larvae of the first of these developed before the lupins were ploughed under and those of the second in plants retained for seed. *H. lupini* has few natural enemies. The adults are destroyed by spiders, and a Pteromalid of the genus *Bubekia* parasitised the larvae or pupae.

Riehl (L. A.), Bartholomew (E. T.) & LaDue (J. P.). **Effects of narrow-cut Petroleum Fractions of naphthenic and paraffinic Composition on Leaf Drop and Fruit Juice Quality of** *Citrus*.—*J. econ. Ent.* **47** no. 1 pp. 107–113, 13 refs. Menasha, Wis., 1954.

The following is based on the authors' introduction and summary. The use of oil sprays on *Citrus* has frequently been reported to cause leaf drop with no evidence of tissue damage and has also been held responsible for a reduction in the content of soluble solids in the juice. In view of this, two series of special narrow-cut fractions, representing distinctly naphthenic and paraffinic types of highly refined petroleum oil [*cf. R.A.E.*, A **42** 290], were applied to lemon and orange trees in southern California at concentrations of 1–4 quarts per 100 gals. and compared with conventional spray oils. Records of the amount of leaf drop on orange and determination of the quality of the juice of orange and lemon fruits harvested after treatment with the various fractions and with conventional spray oils used at 7 quarts per 100 gals. showed that the difference in leaf drop between naphthenic and paraffinic oils was not appreciable, that although leaf drop sometimes increased with an increase in the molecular weight of petroleum fractions in the range of 200–350, it was not greater from trees sprayed with the narrow-cut fractions than from those sprayed with conventional oils of light-medium and medium grades, that treatment with the narrow-cut fractions caused no increase in the percentage of total soluble solids of oranges or in the percentage of acid of lemons, as compared with the conventional oils, and that there was no relation between the molecular weights of petroleum fractions in the range of 200–350 and the effect of the oil on the quality of the juice.

Barker (J. S.) & Tauber (O. E.). **Fecundity of the Pea Aphid on Garden Pea under various Combinations of Light, Moisture, and Nutrients.** —*J. econ. Ent.* **47** no. 1 pp. 113–116, 2 refs. Menasha, Wis., 1954.

Further experiments on the effect of nutritional changes in its food-plants on the fecundity of *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) [*cf. R.A.E.*, A **40** 120] were carried out to test the influence of different levels of nitrogen available to the plant and of high or low carbohydrate level in the plants. Aphids were reared on garden peas grown in a mixture of sand and soil (3:1), with the addition of potassium sulphate and potassium phosphate alone or with 50 or 200 lb. actual nitrogen (from ammonium nitrate) per acre to provide different nitrogen levels, and under conditions of high moisture (100–150 per cent. of normal) and low light (25 per cent. of normal) to produce a low carbohydrate content or of lower moisture (ranging from less than 100 to 115 per cent. of normal) and normal light to produce a high carbohydrate content. The results showed that the highly succulent plants, produced under conditions of reduced light and high moisture, were not so conducive to Aphid reproduction as well differentiated plants, produced under normal light and less moisture, but that small numbers on succulent plants caused more injury than large numbers on well differentiated plants. On the latter, fecundity and plant injury decreased as the nitrogen level increased. As the previous investigations had shown that injury is more severe and the survival period of the Aphid is reduced on nutrient-deficient plants, it is concluded that the decreased fecundity results from a combination of these two factors, rather than from a direct physiological effect on the reproductive mechanism. It is evident that degree of injury is not necessarily an index to Aphid population unless growth factors are uniform.

Wilson (M. C.) & Barber (S. A.). **The Influence of the Sweetclover Weevil and Soil Fertility on Sweetclover Stands.**—*J. econ. Ent.* **47** no. 1 pp. 117–122, 2 graphs, 3 refs. Menasha, Wis., 1954.

Since earlier experiments showed the advantage of applying superphosphate with DDT for the control of *Sitona cylindricollis* Fhs. on sweet clover [*Melilotus*] in Indiana [*cf. R.A.E.*, A **40** 88], further tests were made on the effect of DDT and fertiliser treatments on plant stands. In 1951, the yield of sweet clover grown in the greenhouse in soil containing 60 lb. phosphate and 100 lb. potash per acre and treated with 6 tons of lime per acre was increased as applications of additional phosphate rose from 100 to 1,600 lb. per acre, was not increased by nitrogen or extra lime or by potash applications exceeding 100 lb. per acre, and was decreased by more than 400 lb. potash. When 1–2 lb. DDT, 40 lb. nitrogen, 60 lb. phosphate and 80 lb. potash per acre were applied in various combinations to sprouting sweet clover sown in wheat or oats, the clover grew vigorously and withstood weevil infestation for a month in all plots treated with nitrogen, but then practically disappeared, owing to competition from the cereal, whereas the stand continually increased on all plots receiving no nitrogen. Tests were made in 1952 and 1953 to compare applications of phosphate-potash fertiliser alone, DDT alone and the two together. Increases in stand, plant vigour, the number of leaves per plant, and the weight of roots (and therefore of nitrogen) per acre and decreases in weevil damage to the leaves resulted when the two were combined. Either treatment alone produced a highly significant but smaller increase in roots per acre, with no difference between them, indicating the equal importance of weevil control and soil fertility.

The possibility of combining DDT with liquid nitrogenous fertiliser (in the form of a mixture of ammonium nitrate and urea) in a spray was tested in 1953 by applying nitrogen at 22 lb. per acre, DDT (in an emulsion concentrate) at 2 lb. per acre and a combination of the two. Plant growth was stimulated by the nitrogen and not suppressed by competition with the wheat, the DDT controlled the weevil, and the best stand was obtained with the combined spray, there being no difference between applications on 11th and 30th April; because of the persistent effect of DDT, the treatment could probably be applied as early as 1st April, as or just before the sweet clover appeared above ground. Combining DDT with nitrogenous fertiliser in a spray is easier and cheaper than other methods of application, but care should be taken to avoid an excessive application of nitrogen.

DEEN (O. T.) & HALLOCK (H. C.). **Beet Leafhopper Control Experiments on Snap Beans grown for Seed.**—*J. econ. Ent.* **47** no. 1 pp. 122–126, 7 refs. Menasha, Wis., 1954.

Since about 80 per cent. of the snap-bean seed required in the United States is produced in southern Idaho, the prevalence of curly-top disease in the crop is of importance, and an attempt was therefore made to develop a method of direct control of *Circulifer tenellus* (Baker), the vector of the virus, on the bean plants. Six insecticides that had shown promise in the laboratory were tested in the field in 1948–52, but only in 1949 and 1950 was the level of infection high enough for differences between treatments to be significant. Three applications were made at weekly intervals, beginning when the plants were in the " crookneck " stage of growth. Sprays were applied to give 1·5 lb. toxicant in 100 U.S. gals. per acre, except for schradan, which was used at 1 U.S. pint 66 per cent. emulsion concentrate, and dusts at 1–3 lb. toxicant in 20–30 lb. per acre. None of the insecticides gave adequate protection from the disease, the greatest reduction in infected plants being 68 per cent., but in 22 small-plot tests with hand equipment, an emulsion spray of purified DDT reduced the percentage of infection more than a suspension of CS-674A [1,1-bis(p-chlorophenyl)-2-nitrobutane] or the schradan emulsion, and a 5 per cent. dust of purified DDT reduced it more than dusts of CS-708 [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane], p,p′methoxy-DDT (methoxychlor) or a mixture of equal quantities of DDT and ethyl-DDD (Q-137 [1,1-bis(p-ethylphenyl)-2,2-dichloroethane]) in most tests.

Three applications of 5 per cent. DDT dust to beans growing in sparse, medium and dense stands reduced curly-top significantly, but the protection afforded in the sparse one was inadequate; yield increases occurred in all three. The same dust, applied to large plots with a power duster in 1950 and 1951, reduced the infection on seven varieties of susceptible beans by 36 per cent. and caused increases in yield, averaging 72 lb. per acre, on all of them.

Preliminary tests indicated that purified DDT is less likely to damage the plants than technical DDT in either emulsion sprays or dusts; in field tests, the two grades gave about the same reduction in infection, but the purified DDT resulted in greater increases in seed yield.

GREEN (H. B.). **Ventilation of small Cage Battery.**—*J. econ. Ent.* **47** no. 1 p. 126. Menasha, Wis., 1954.

Details are given of a method of ventilating a set of cages in which small grain plants are enclosed individually, so that plant growth is uniform. It has the advantage that any one plant can be removed for counting, infestation or other purposes.

Dickason (E. A.). **Biology of *Meligethes seminulum* Lec.**—*J. econ. Ent.* **47** no. 1 pp. 127–129, 3 refs. Menasha, Wis., 1954.

Meligethes seminulum Lec., all stages of which are briefly described, became of importance in Oregon towards 1940, when it appeared in large numbers on red clover. It is commonest in the west, but has been collected throughout the State, and occurs discontinuously across the whole of the northern United States and southern Canada. Investigations on its bionomics and control and its relation to clover-seed production were begun in Oregon in 1949. These showed that the Nitidulid has one generation a year. The adults overwintered in plant débris and protected areas near the soil surface and resumed activity in late March. They were active in warm weather, fed on the pollen of various plants, and paired in late April or early June, at least four weeks after emergence. The beetles occurred on the unopened buds and racemes of leguminous plants several days before the flowers opened, mainly in May and June, and oviposition began in the basal flowers, progressing outwards as the flower head developed. The eggs were deposited between the calyx and corolla, singly or in groups of 2–4, and hatched in 3–4 days in the laboratory. Larvae were found in the flowers of white clover (*Trifolium repens*), alsike clover (*T. hybridum*), red clover (*T. pratense*), *Lotus corniculatus*, hairy vetch (*Vicia villosa*) and common vetch (*V. sativa*), but the native food-plant was not determined. The larvae were present in the field from early May until July, were active for about three weeks, crawling from one flower to another within the head or raceme and feeding mainly on pollen, but also on plant tissue in the undeveloped flowers, and then pupated in loose soil at a depth of 0·5–1·5 ins. The pupal stage was completed in 8–9 days in the laboratory, but the period between entry into the soil and the occurrence of mature adults probably lasts a fortnight in the field. Most of the adults emerged by mid-July. They fed in the flowers, and most sought hibernation quarters in early August, though a few were found until mid-September.

The larvae do not significantly affect the production of red-clover seed, as the first blooms are removed with the hay in early June, but the newly emerged adults cause considerable damage in July to the blossoms that set the seed crop, rendering them unattractive to pollinating insects. The increase in the Nitidulid appears to have been due to the increased cultivation of hairy vetch, which is at present the main food-plant of the larvae. Control by adjusting the cutting dates of red clover proved ineffective because of the presence of other leguminous plants, and the insect's migratory habit, its extended period of emergence from the soil and the protection afforded by the flowers render control by insecticides difficult. When populations were low, toxaphene was the most effective insecticide tested against the adults in July, but none gave satisfactory control of populations exceeding 12 beetles per flower head, reinfestation occurring within 5–8 days.

Pritchard (A. E.). **The White Clover Flower Midge as differentiated from the Red Clover Flower Midge (Diptera: Itonididae).**—*Pan-Pacif. Ent.* **29** no. 3 pp. 128–132, 2 figs., 8 refs. San Francisco, Cal., 1953.

Bishop (G. W.). **Life History and Habits of a new Seed Midge, *Dasyneura gentneri* Pritchard.**—*J. econ. Ent.* **47** no. 1 pp. 141–147, 2 refs. Menasha, Wis., 1954.

In the first paper, descriptions are given of the adults of both sexes of *Dasyneura gentneri*, sp.n., reared from the flowers of ladino clover

[*Trifolium repens latum*] in Oregon and Washington, together with characters of the male genitalia differentiating it from *D. leguminicola* (Lint.), which attacks red clover [*T. pratense*] in the United States, Canada and Europe and of which *D. flosculorum* (Kieff.) is considered a synonym [*cf. R.A.E.*, A **21** 211].

In the second paper, it is stated that *D. gentneri* was also reared in Oregon from alsike clover [*T. hybridum*] growing near infested ladino clover and that some evidence was obtained that it may occasionally infest red clover. Investigations on its bionomics were carried out in 1950–52, and the following is based on the author's summary of the results. The Cecidomyiid is of importance in areas in which ladino clover is grown for seed. It overwintered as a full-fed larva in a cocoon, and spring emergence began in mid-May in southern Oregon and continued through early June. The adults were active in infested fields during the summer and autumn of 1951 and 1952, and populations were highest during late August and early September. The eggs were deposited in the open florets, and the larvae fed on the pods by sucking the sap, later dropping to the ground and pupating in silken cocoons under débris or loose soil. The egg, larval and combined prepupal and pupal stages averaged 2·3, 13 and 13·9 days, respectively, and field observations indicated that there are 3–4 generations a year. Adults survived for 2–4 days in the laboratory, and sexual maturity was apparently reached within a few hours after emergence. The larvae were parasitised by *Tetrastichus* sp. and an undescribed species of *Ceraphron*.

BRUNSON (M. H.) & ALLEN (H. W.). **Joint Use of Parasites and Insecticides for Control of the Oriental Fruit Moth.**—*J. econ. Ent.* **47** no. 1 pp. 147–152, 3 refs. Menasha, Wis., 1954.

The following is based partly on the authors' summary. In 1938–47, mass liberation of parasites, mainly *Macrocentrus ancylivorus* Rohw., against first- and second-generation larvae of *Cydia* (*Grapholitha*) *molesta* (Busck) on peach near Moorestown, New Jersey, reduced injury to the ripe fruits by an average of nearly 50 per cent. [*cf. R.A.E.*, A **33** 106]. The use of DDT and other insecticides in pre-harvest applications subsequently became almost the only method of control, and natural enemies were largely disregarded. In view of the possibility that wide application of the insecticides might reduce the high natural population of parasites, experiments were carried out in 1947 and 1949–52 in which the trees received either parasites or sprays or both.

Mass liberations of *M. ancylivorus* were made against the first two generations, at rates not exceeding six females per tree, and were followed by one or two pre-harvest sprays of about 1 lb. actual DDT, 0·2–0·3 lb. parathion or 0·375 lb. EPN [ethyl p-nitrophenyl thionobenzenephosphonate] in wettable powders or 0·5 U.S. pint Metacide emulsion concentrate containing 50 per cent. active ingredients [methyl-parathion with a smaller quantity of parathion] per 100 U.S. gals. The parasite liberations reduced fruit injury by an average of 52 per cent. (64 per cent. in the last three years), and one application of insecticide reduced it by 44–83 per cent.; the differences between insecticides or between one and two applications, though sometimes great, were not significant. In the last three years, the joint use of parasites and one insecticide application reduced the injury to 2·6 per cent. in orchards in which it was 23–25 per cent. on trees receiving no treatment of any kind.

Gow (P. L.). **Proteinaceous Bait for the Oriental Fruit Fly.**—*J. econ. Ent.* **47** no. 1 pp. 153–160, 15 refs. Menasha, Wis., 1954.

The following is based on the author's introduction and summary. Methyl eugenol proved a powerful attractant for males of *Dacus dorsalis* Hend. in Hawaii [*cf. R.A.E.*, A **40** 230], but an effective lure for the females and for *D. cucurbitae* Coq. and *Ceratitis capitata* (Wied.) was still required. In tests of possible materials, hydrolysates of yeast, soy bean [*cf.* **41** 143], lactalbumin and casein and a vitamin B preparation (Lederplex) were all attractive to adults of *D. dorsalis*, soy-bean hydrolysate being somewhat superior to the others, but pure samples of the vitamins present in Lederplex, alone or in combination, were not. The attractiveness of the proteinaceous materials appeared to be due chiefly to products of microbiological action. Of 14 strains of micro-organisms isolated from effective baits and cultured on proteinaceous materials, a species of *Proteus* (probably undescribed) consistently resulted in high attractiveness. The production of attractants by it was not affected by pH values between 5 and 10·5, and the best results were given by a culture period of two weeks. The addition of as little as 0·5 per cent. dextrose to a culture medium consisting mainly of soy-bean hydrolysate depressed the attractiveness of the bait materially, indicating that the production of attractants is associated with the use of the proteinaceous materials as a source of energy in metabolism.

In further tests, a bait of soy-bean meal in water precultured for a week with the *Proteus* bacterium at 80°F. proved superior to soy-bean hydrolysate cultured in a similar way and its attractiveness was increased by culturing under aerobic conditions and also by the removal of the ammonia produced, indicating that ammonia is only a mild attractant for *D. dorsalis* and that at some concentrations it may actually be repellent. The attractants in this bait were apparently non-volatile, since they were not removed by high vacuum, and they are believed to be water-soluble. Its performance in attracting the females of *D. dorsalis* was superior to that of the other baits tested, but the catches in traps containing it were not large enough for control purposes. Isolation of the attractants and elimination of any repellents present might lead to a more effective and useful material. The bait also proved attractive to *D. cucurbitae* and *C. capitata*.

Madsen (H. F.) & Borden (A. D.). **Codling Moth and Orange Tortrix Control on Apricots in California, 1948–1953.**—*J. econ. Ent.* **47** no. 1 pp. 161–165, 2 figs., 5 refs. Menasha, Wis., 1954.

The codling moth [*Cydia pomonella* (L.)] caused widespread damage to apricots in the central-coast counties of California, especially in the Santa Clara Valley, in 1947, and investigations on its control were begun in 1948. Apricots are regularly sprayed at the pink-bud or jacket stage with either DDT or basic lead arsenate for the control of insects attacking the twigs and leaves, but later applications of these materials would cause a residue problem, as apricots ripen early in July and spray residues are difficult to remove from them.

Bait-pan catches in 1948–49 showed that moth activity began in late April or early May and was greatest in mid-May, and in the tests described, in which all spray quantities are given per 100 U.S. gals., sprays of 3 lb. 25 per cent. parathion or 50 per cent. p,p′methoxy-DDT (methoxychlor) or 2 lb. 50 per cent. DDD (TDE), applied in 1949 at 10 U.S. gals. per tree at the jacket stage (early April) and in early May, or in early May after an application of 1·5 lb. 50 per cent. DDT in early April, reduced the percentage of infested fruits at harvest from 6 to less than 2. Parathion left a small residue that disappeared when the fruits were dried, and methoxy-DDT left one that might be safe as this compound has low toxicity to man, but DDD left residues of 2·6 and 7·1 parts per million, respectively, on the fresh and dried fruits after two applications.

In 1950–51, damage by *C. pomonella* decreased and that by the orange tortrix [*Tortrix citrana* Fern.] increased, and in the latter year a spray of 2 lb. 50 per cent. methoxy-DDT in late May, and the same after a spray of 1·5 lb. 50 per cent. DDT in April or before a spray of 2 lb. 25 per cent. parathion in June, proved effective against both insects. In 1952, sprays of DDT at the pink-bud stage, DDD at petal-fall and parathion in May, applied by growers, gave complete protection against *T. citrana*, and in 1953, sprays of 2 lb. 50 per cent. DDD in mid-March and 2 lb. 25 per cent. parathion in mid-May gave complete control of both insects. Control was not affected by substituting 4 lb. 25 per cent. malathion for parathion in the second application or by delaying the latter application until June, but the later application increased the parathion residue, and since May is the best time for controlling *C. pomonella*, a change would not be advantageous. Sprays of 4 lb. Perthane, which contains 25 per cent. ethyl-DDD (Q-137 [1,1-bis(p-ethylphenyl)-2,2-dichloroethane]), on both dates were ineffective against *T. citrana* and left a rather high residue on the fruits at harvest.

FLEMING (W. E.) & MAINES (W. W.). **Persistence of Chlordane in Soils of the Area infested by the Japanese Beetle.**—*J. econ. Ent.* **47** no. 1 pp. 165–169, 5 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. An investigation was begun in 1947 on the persistence of chlordane in soils of the region of the United States infested by *Popillia japonica* Newm. Experimental plots were established in four States, and tests were made with samples of 83 representative mineral soils from eight. The chlordane residues were determined by chemical analyses and by bioassays, in which third-instar larvae of *P. japonica* served as the test insects.

When chlordane was applied at the rate of about 10 lb. per acre as a top dressing to established turf, about 33 per cent. of it remained after 1½ years, and about 5 per cent. after 2½ years, but there was little change during the next three years. When it was mixed with soil at rates of 1–25 lb. per acre and exposed to weathering in pots, the amounts of residue after 1–5 years were proportional to the quantity of chlordane applied, but the rate of reduction was lower than in the field. There was considerable variation in residues in the 83 mineral soils. In the most retentive group, 84 per cent. of the chlordane applied remained after one year and 50 per cent. after two, whereas in the least retentive these percentages were only 23 and 10, respectively. Residues in all the soils tended to approach the general average of 12 per cent. after three years and 5 per cent. after four, and they tended to be greater in soils from the southern part of the region than in those from the north. They decreased as the amount of organic matter in the soil increased. With the exception of nitrogen, which is associated with organic matter, no relation was found between the amount of residue and soil elements. Soil texture was not important.

BOOCOCK (D.). **Control of Brown-tail Moth with a portable Fog Generator.** —*J. econ. Ent.* **47** no. 1 pp. 171–172, 4 refs. Menasha, Wis., 1954.

An outbreak of brown-tail moth, *Euproctis chrysorrhoea* (L.) (*Nygmia phaeorrhoea* (Don.)), began on gorse and blackberry bushes on uncultivated land near Brighton, on the south coast of England, in 1953. It spread to neighbouring gardens, and the larvae invaded houses, where they constituted a nuisance and caused severe skin irritations. Control measures carried out included clearing and burning the herbage and spraying with DDT. The sprays were effective against exposed larvae but not those in sheltered situations, and were expensive. A portable Swingfog machine, which generates a fog by atomising a solution of insecticide into a stream of hot gas produced by a pulse-jet engine, was therefore used to treat infested bushes. In a test in which the fog was generated from a solution of 10 per cent. DDT (75–80 per cent. p,p′-isomer) in fog oil and applied to a heavily infested hedge of *Euonymus europaeus* by passing the machine twice in front of it at a distance of 2 ft. so that the fog passed over each part for about a minute, the larval population was reduced by some 80–90 per cent. in ten minutes, affected larvae falling to the ground. Fallen larvae failed to feed when caged with untreated *Euonymus* leaves and died within three days, whereas untreated individuals behaved normally. Untreated larvae confined with treated leaves collected one and seven days after fogging suffered 84 and 19 per cent. mortality, respectively, and infestation was very low on the treated plants at these times, though undiminished on untreated ones; there was no rain during the first 24 hours after treatment and 0·6 ins. in the next six days.

CHAMBERLIN (F. S.). **Insecticides for Tobacco Budworm Control on Shade-grown Tobacco.**—*J. econ. Ent.* **47** no. 1 pp. 172–173, 3 refs. Menasha, Wis., 1954.

Tests were carried out in Florida in 1949–52 on the control of *Heliothis virescens* (F.) on tobacco. In 1949, 10 per cent. DDT dust, which had controlled the larvae on flue-cured tobacco in South Carolina [*cf. R.A.E.*, A **36** 372], proved effective on shade- and sun-grown cigar tobacco and did not damage the foliage when applied with rotary hand dusters. Finely ground sterilised tobacco dust was the most satisfactory diluent. The subsequent tests were carried out on shade-grown tobacco, and in 1950 this was treated once a week with various dusts in ground tobacco at 8 lb. per acre or with the standard bait of maize meal and lead arsenate (75:1).

The first nine dust applications were directed towards the buds and the last three to the upper leaves, and 1 per cent. parathion was included for Aphid control. Examination after each treatment showed that the percentages of leaves injured were less than 1 for 10 per cent. DDT alone or with parathion and for 10 or 15 per cent. DDD (TDE) with parathion, less than 4 for 5 per cent. DDT or 10 per cent. toxaphene with parathion, over 35 for parathion alone, over 40 for 10 or 15 per cent. p,p′methoxy-DDT (methoxychlor) with parathion, and 12·3 for the bait, as compared with 81·9 for no treatment. The bait should have been applied twice a week for good control; it proved injurious to the bud leaves late in the growing season. The addition of parathion did not increase the effectiveness of DDT, but controlled heavy infestation by *Myzus persicae* (Sulz.).

In 1951, when nine weekly dust applications at nearly 7 lb. per acre were made to the bud leaves and three at 10 lb. to the upper leaves, 1 per cent. parathion with 10 per cent. DDT or DDD resulted in less than 1 per cent. injured leaves, and 1 per cent. parathion alone, 2 per cent. methyl-parathion and 2 per cent. O,O-diethyl O-7-hydroxy-4-methyl-coumaryl thiophosphate (4-methylumbelliferone O,O-diethyl thiophosphate) in 17·7, 4·9 and 37 per cent., respectively. After the first four applications of the last, 1 per cent. parathion was added to control a serious increase in Aphids.

In 1952, when 11 weekly applications were made at about 9 lb. per acre, 10 per cent. DDT with 1 per cent. parathion or methyl-parathion and 10 per cent. DDD with 1 per cent. parathion resulted in less than 2 per cent. injury and the dusts including parathion were not affected by the addition of 6·5 per cent. of the fungicide zineb [zinc ethylene bis(dithiocarbamate)], whereas 1 per cent. CS-708 [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] with 1 per cent. parathion permitted 13·7 per cent. injury. Tobacco dust and fuller's earth appeared equally effective as diluents and none of the treatments injured the foliage.

Stitt (L. L.). **Garden Springtail Investigations.**—*J. econ. Ent.* **47** no. 1 pp. 173–174, 4 refs. Menasha, Wis., 1954.

In view of considerable damage by *Bourletiella hortensis* (Fitch) to spinach, beans, cucumber and squash in Washington in recent years, insecticides were tested for its control in 1950–51. In preliminary tests, dusts of DDT, BHC, chlordane and p,p′methoxy-DDT (methoxychlor) gave fair immediate knockdown on beans, but unsatisfactory control; chlordane retarded reinfestation. In 1951, dust applications of 5 per cent. DDT, p,p′methoxy-DDT or chlordane, 1 per cent. parathion or 4 per cent. malathion at 25 lb. per acre to spinach on 22nd April or of 1 per cent. rotenone at 50 lb. on 23rd April resulted in populations of 9, 6, 17, 0, 0 and 122 per 10 plants on 1st May. Further applications of 2·5 per cent. aldrin and of the dusts of chlordane, DDT, malathion, p,p′methoxy-DDT and parathion on 7th May to the plots previously treated with rotenone resulted in 50, 34, 67, 7, 86 and 1, as compared with 94 for no treatment, and it is concluded that only parathion and malathion were effective. Leaves picked from the spinach plants 11 days after dusting with parathion bore residues of 0·32 part per million. Plants dusted with malathion had residues of about 101–167 p.p.m. immediately after treatment and of 0·4 p.p.m. in two tests and 8·1 p.p.m. in another after five days.

Gray (H. E.). **The Development of the** *Citrus* **Mealybug.**—*J. econ. Ent.* **47** no. 1 pp. 174–176, 1 graph, 7 refs. Menasha, Wis., 1954.

In laboratory studies on the development of *Planococcus* (*Pseudococcus*) *citri* (Risso), nymphs hatched in 2–3 days from newly deposited eggs collected from ovisacs and kept in a moist petri dish. They were placed on potato shoots in test-tubes and were active at first, but eventually began feeding and produced large quantities of honeydew. They moulted for the first time eight days after hatching and were transferred to fresh shoots, on which they soon fed again and produced honeydew. Similar transfers were made after each moult. The males formed loosely spun cocoons four days after the first moult and moulted for the second, third and fourth times after further successive intervals of 2, 2–3 and 4 days, respectively, losing the stylets at the second moult. Adult males remained in the cocoons for 1–2 days after the final moult and normally lived for 4–7 days, during which they were very active. Female nymphs continued to feed and completed their second and third instars in about five and six days, respectively, after which they transformed to adults. They paired with the males a few hours after moulting, and egg-production began after a week and continued for 30–45 days, until death. Third-instar females that were caged alone moulted and grew to normal size, but did not produce eggs, and it is concluded that *P. citri* is not parthenogenetic. Large numbers of adult males were attracted from distances of 10–15 ft. to the tubes containing the newly transformed females, presumably by the scent of the latter. The weights of the eggs and of the two sexes at the various stages of development are shown; that of the males increased until cocoon-formation and then decreased, while that of the females increased until egg-production began.

HANTSBARGER (W. M.) & O'NEILL (W. J.). **Predaceous Mites of the Family Laelaptidae in north-central Washington.**—*J. econ. Ent.* **47** no. 1 pp. 176–177, 2 refs. Menasha, Wis., 1954.

Collections of predacious mites in apple orchards and on natural vegetation in the Wenatchee area of Washington in the growing seasons of 1951–52 showed that the Laelaptid, *Typhlodromus longipilus* Nesbitt, was the only one preying on Tetranychid mites in the orchards. It attacked all the species of local importance, preferring the eggs and nymphs, and destroyed many during its lifetime. The male is unknown. *T. rhenanus* (Oudm.) was abundant on certain wild trees, and *Phytoseius spoofi* (Oudm.) was taken on one occasion on elder (*Sambucus* sp.).

SMITH (G. L.), RICHMOND (C. A.) & NOBLE (L. W.). **Mixtures of DDT and other Insecticides for Control of Pink Bollworms and Boll Weevils in southern Texas.**—*J. econ. Ent.* **47** no. 1 pp. 177–178. Menasha, Wis., 1954.

The results are given of five large-scale experiments carried out on cotton in southern Texas in 1952 to evaluate mixtures of DDT with other insecticides against heavy infestations of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) and also against *Anthonomus grandis* Boh., where this weevil was injurious. The insecticides were applied in emulsion sprays, unless otherwise stated, usually with tractor-type machines that delivered about 5 U.S. gals. per acre. Treatments were made against *Platyedra* weekly, except where weevil infestation made shorter intervals desirable. DDT with dieldrin, EPN [ethyl p-nitrophenyl thionobenzenephosphonate], BHC or toxaphene was applied for the control of both insects, and dieldrin, which is not effective against *Platyedra*, against the weevil alone. Amounts of insecticide in the following are of actual compound per acre.

In the first test, the percentages of squares punctured by the weevil, numbers of larvae of *Platyedra* per boll (seasonal average) and yields in lb. seed cotton per acre were 39, 17·9 and 170 for four applications of 0·375 lb. dieldrin, 32, 2·7 and 843 for nine of 2 lb. DDT with 0·375 lb. dieldrin, and 38, 16·8 and 133 for no treatment. In the second, they were 55, 6·3 and 1,276 for 13 applications of 0·45 lb. dieldrin, 44·8, 0·8 and 2,345 for 13 of 1·63 lb. DDT with 0·45 lb. dieldrin, and 80·1, 6·8 and 805 for no treatment. In the third, they were 41, 7·6 and 1,325 for five applications of 0·375 lb. dieldrin, 35, 1·6 and 1,803 for eight of 2 lb. DDT with 0·375 lb. dieldrin, and 35, 0·9 and 2,254 for eight of 2 lb. DDT with 0·5 lb. EPN. In the fourth, they were 15, 3·6 and 1,045 for eight applications of 1·5 lb. DDT with 0·25 lb. dieldrin, 16, 1·2 and 1,370 for eight of 1 lb. DDT with 0·5 lb. EPN, 30, 4 and 800 for eight of 2 lb. DDT with 0·4 lb. γ BHC in a dust, and 47, 13·4 and 265 for no treatment. In the fifth they were 7, 2·7 and 740 for seven applications of 1·5 lb. DDT with 3 lb. toxaphene in a dust and 53, 21 and 0 for no treatment. In the first and third tests, only 4–5 applications were needed for weevil control.

It is concluded that the higher yield increases resulted from control of *Platyedra*, that dieldrin with DDT gave much better control of the weevil than dieldrin alone, and that the addition of EPN to DDT increased control of *Platyedra*, with satisfactory weevil control.

SUN (Yun-pei) & PANKASKIE (J. E.). *Drosophila*, **a sensitive Insect, for the Microbioassay of Insecticide Residues.**—*J. econ. Ent.* **47** no. 1 pp. 180–181, 5 refs. Menasha, Wis., 1954.

Adults of *Drosophila melanogaster* Mg. have been found to be as sensitive as mosquito larvae and as easily handled as house-flies [*Musca domestica* L.] for the bioassay of insecticide residues in plant and animal tissues, with no apparent differences in susceptibility between one wild and two laboratory strains to several insecticides, and two methods of using them are described. In the first, which is suitable for plant material, day-old adults reared in the laboratory by a method already noticed [*R.A.E.*, A **39** 400] are exposed to macerated untreated tissue to which known quantities of insecticide have been added in not more than 0·5 ml. acetone solution per 25 gm. sample and to macerated treated tissue to which the same amount of acetone has been added. The insects are anaesthetised with carbon dioxide and placed in a small glass cup, which is put in a jar with the macerated material, so that the flies do not adhere to this while recovering from anaesthesia, and mortalities are compared after 18–48 hours, when that in the standard reaches 30–80 per cent. For routine tests in which it is desired to know whether the residue is below a certain level, it is necessary only to compare the mortality of flies exposed to treated samples with that in the standard at that level alone, but to evaluate higher residues it may be necessary to use standards containing 3–4 levels of the toxicant. As little as 0·1 part aldrin or dieldrin per million can be detected in many fresh or canned fruits and vegetables by this method.

The second consists of exposing *Drosophila* to dried residues from extracts of the materials as previously described for *M. domestica* [**40** 167], except that the extract is deposited on the bottom of a wide-mouthed 4-oz. jar, pumpkin serves as food for the flies, and the jars are covered with tissue paper. It is adopted when the nature of the tissue to be assayed renders the first method unusable or the sample is small. It proved suitable for bioassay of aldrin and dieldrin in animal tissues, and as little as 0·05 mmg. of these insecticides per jar can be detected by it.

Since *Drosophila* is more susceptible than *M. domestica* to insecticide contamination and to natural toxicants extracted from plant or animal tissues, it should be used only to determine minute quantities of toxicant that cannot be detected by the latter. Comparison of the minimum amounts of γ BHC, aldrin, dieldrin and DDT detectable by *M. domestica* and *Drosophila* in the second method and by larvae of *Aëdes aegypti* (L.) based on the work of Hartzell & Storrs [**40** 154] showed that *Drosophila* is about as sensitive as the mosquito larvae and more sensitive than *M. domestica*, though it was far less sensitive than the latter in detecting these insecticides in milk by a feeding method [**42** 283].

TATTERSHALL (J. T.) & DAVIDSON (R. H.). **Life History and Control of** *Apion longirostre* **Olivier.**—*J. econ. Ent.* **47** no. 1 pp. 181–182, 2 figs., 3 refs. Menasha, Wis., 1954.

Apion longirostre Ol., which feeds only on hollyhock [*Althaea rosea*], is widespread in the United States. It has one generation a year and apparently overwinters in the adult stage. The eggs are deposited in the buds in June and hatch in three or more days. The larvae destroy the seed embryos and pupate in the space produced, and the adults emerge in early August and feed on the leaves and buds.

Confining field-collected adults on filter papers dipped in acetone solutions of 0·01 per cent. aldrin, chlordane, DDT, dieldrin, heptachlor and lindane (almost pure γ BHC) resulted in complete mortality in 48 hours, and concentrations of 0·001 per cent. in 5, 0, 0, 20, 5 and 40 per cent., respectively, in 48 hours. It is concluded that dusts or sprays of any of these compounds would be effective against the weevil. Applications should be made in spring, when the adults are feeding on the leaves and before the flower buds become well developed.

RICHARDSON (H. H.). **Preliminary Tests with Carbon Monoxide against several Insects.**—*J. econ. Ent.* **47** no. 1 pp. 182–183, 10 refs. Menasha, Wis., 1954.

In preliminary tests in 1943, fumigation with carbon monoxide at a concentration of 18 lb. per 1,000 cu. ft. for 24 hours at a temperature of 76–78°F. and 30–50 per cent. relative humidity gave an average of 43·6 per cent. mortality of *Tribolium confusum* Duv. and was still less effective against four other insects [*cf. R.A.E.*, B **42** 191].

SMITH (F. F.), GIANG (P.) & FULTON (R. A.). **Residues of Malathion on Greenhouse Lettuce and Tomatoes and on green Onions.**—*J. econ. Ent.* **47** no. 1 pp. 183–185, 2 refs. Menasha, Wis., 1954.

In greenhouse tests in which aerosols of 10 or 15 per cent. malathion in methyl chloride were applied at sunset to give concentrations of 1 or 1·5 gm. per 1,000 cu. ft., respectively, and the greenhouse was kept closed for 12–15 hours at 70°F., residues on lettuce treated with 10 per cent. malathion were 9·75 and 0·46 parts per million one and nine days after treatment, respectively, as compared with 21·8 and 4·5 p.p.m. for similar treatment with parathion [*cf. R.A.E.*, A **41** 84]. On immature and mature lettuce treated with 15 per cent. malathion, residues were 15–16 p.p.m. after one day and less than 0·5 p.p.m. after nine; the higher residues in this test may have been due to the larger particle size, and hence greater deposit, characteristic of more concentrated aerosols [*cf.* **38** 221]. In both tests, the reduction in residue was mainly due to chemical changes and volatilisation. On tomato fruits treated with the 10 per cent. malathion aerosol, the residues were 0·31–0·41 p.p.m. one hour after treatment and 0 after three days, and those from the 15 per cent. aerosol were 1·05 p.p.m. after one hour and 0·02 p.p.m. after nine days. They were again lighter than those from parathion.

When onions planted in field plots on 10th March were treated on 11th May and 2nd June with 1·2, 0·5 or 1 lb. malathion per acre in dusts, wettable-powder sprays and emulsion sprays, respectively, heavy rainfall on the second day after the first treatment removed all residues, and the residues from the second, which were exposed to dew but not rain, almost disappeared in a week. The residues were not proportional to the amount of insecticide applied, but greatest for the wettable-powder spray and least for the dust.

LEE (Sung-yang). **Effect of Calcium Cyanamide on the Rice Borer.**—*J. econ. Ent.* **47** no. 1 pp. 186–187. Menasha, Wis., 1954.

Although *Schoenobius bipunctifer* (Wlk.) (*incertellus* (Wlk.)) has long been the most serious insect pest of rice in Formosa [*cf. R.A.E.*, A **5** 574], burning or burying the stubble during winter to kill the hibernating larvae has been the only satisfactory control measure known. In tests of more economic means of destroying the stubble, it was observed in 1950 that small quantities of calcium cyanamide, applied to the culms, hastened decay and killed the larvae, and field and laboratory experiments were therefore carried out in 1950–51 to investigate the effectiveness and mode of toxicity of the compound.

Applications of 0·5, 1 or 2 gm. calcium cyanamide per plant were made in November, on the day after harvest, to stubble in soil containing 18, 23 or 34 per cent. moisture or under about an inch of water. The effect of the chemical on both stubble and insect was usually visible within three days of application. Larval mortality was 11–13 per cent. on the second day and 50–73 per cent. on the eighth, but did not increase further. There was evidence that the larvae were killed not only through decay of the stubble, but also by some toxicant derived from calcium cyanamide that probably acted as a fumigant. In all tests a few culms were little affected by the poison, and in these fewer insects were killed. The lowest rate of application had little effect on stubble 2–7 ins. high, but was as effective as the higher ones if the plants were cut at the soil surface; there was no significant difference between the other rates. Application to withered stubble or to stubble in severely dried soil (18 per cent. moisture) or under water was ineffective. Application of even 10 gm. per plant round but not on the culm killed very few of the larvae.

WALL jr. (W. J.) & SWIFT (A. H. P.). **The digestive Enzymes of the Firebrat.**—*J. econ. Ent.* **47** no. 1 pp. 187–188, 2 refs. Menasha, Wis., 1954.

Thermobia domestica (Pack.), a common household pest in New York State, has feeding habits that resemble those of cockroaches, and the enzymes present in its digestive tract were therefore investigated. Chemical tests revealed the presence of maltase, invertase, lipase, trypsin and erepsin, but not of amylase, lactase or pepsin. The digestive tract thus contains enzymes that digest starch, fat and protein, and the insect can therefore feed on materials of animal and vegetable origin. The similarity between the digestive enzymes of *T. domestica* and those recorded for *Blatta orientalis* L. indicates that the nutritional requirements of the two species are closely allied.

BEROZA (M.) & BOTTGER (G. T.). **The insecticidal Value of** *Tripterygium wilfordii*.—*J. econ. Ent.* **47** no. 1 pp. 188–189, 11 refs. Menasha, Wis., 1954.

In the course of investigations on the insecticidal alkaloids extracted from the root of *Tripterygium wilfordii* [*cf. R.A.E.*, A **42** 65, etc.], it was found that newly hatched larvae of *Pyrausta nubilalis* (Hb.), confined on maize leaves treated with a spray containing 60 parts per million pure wilforine, wilforgine, wilfordine and wilfortrine, respectively, suffered 88, 30, 54 and 48 per cent. mortality in two days and 100, 54, 100 and 73 per cent. in three. Leaves treated with a spray containing 60 p.p.m. of the non-crystalline fraction remaining after removal of the crystalline material gave about 90 per cent. kill in two days, and others treated with a spray of 4 lb. root powder per 100 U.S. gals. water killed 81 and 96 per cent. in two and three days, respectively. Insufficient wilforzine was available for comparative tests, but it showed definite toxicity to larvae of *Plutella maculipennis* (Curt.), though much less than wilforine.

Lists are given of insects against which the root powder proved effective in tests, against which it showed some toxicity and against which it was completely ineffective. At 50 mg. per ml. in oil spray, the root showed no synergism with pyrethrins. Baits containing 20 per cent. ground whole root, 0·5 per cent. non-crystalline alkaloid or 0·5 per cent. crystalline fraction were not toxic to rats.

CUTRIGHT (C. R.). **A Codling Moth Population resistant to DDT.**—*J. econ. Ent.* **47** no. 1 pp. 189–190. Menasha, Wis., 1954.

A petal-fall and six cover sprays of lead arsenate gave poor results against the codling moth [*Cydia pomonella* (L.)] in an apple orchard in Ohio in 1944, about 80 per cent. of the fruits being damaged. In 1945, five cover sprays were applied, and the percentages of fruits infested and (in brackets) superficially injured were 12 (39) for 3 lb. lead arsenate per 100 U.S. gals. and 0·5 (1·8) for 4 lb. 25 per cent. wettable DDT. DDT had not been used in the orchard before, and its effectiveness led to its adoption in the regular spray schedule. In 1951, however, control was unsatisfactory, and in 1952 a parathion schedule gave much better results than DDT. Replicated experiments were therefore carried out in 1953 in which six spray schedules were tested in randomised blocks. Each formulation was applied seven times with a fungicide between 21st May (first cover spray) and 4th August. Preliminary counts on 10th July indicated a difference between treatments, and examination of dropped and picked fruits on 8th September showed that the numbers of larvae per 100 apples were 95·8 and 94·3 for 1·5 and 2·5 lb. 50 per cent. wettable DDT per 100 U.S. gals., 14·6 for 3 lb. lead arsenate, 10·4 and 10·1 for 1·5 and 2·5 lb. 15 per cent. wettable parathion and 24·7 for 2 lb. Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane]. It is concluded that the population of *C. pomonella* had developed a resistance to DDT.

GOULD (G. E.) & MCCROSKY (L. L.). **Potato Flea Beetle Control with new Insecticides.**—*J. econ. Ent.* **47** no. 1 p. 190. Menasha, Wis., 1954.

In Indiana, applications of 0·75 lb. actual DDT per acre to potato in the first 6–7 and usually in the 8th and 10th of a series of about 15 weekly fungicidal sprays gave excellent control of the potato leafhopper [*Empoasca fabae* (Harris)] and, until 1951, of potato flea-beetles (mainly *Epitrix cucumeris* (Harris)). Examination of a number of farms in northern Indiana in 1952 showed that there was a considerable increase in flea-beetles on all of them. During that year most growers replaced DDT by one of the phosphorus compounds, with the result that control of *Epitrix* was excellent, that of *Empoasca* was fair to good, and Aphids, which had usually been present when the DDT schedule was applied, were absent throughout the season. In 1953, several materials were tested for the control of *Epitrix* in emulsion sprays applied at 75 U.S. gals. per acre on 28th May and 1st, 9th, 15th and 22nd June. The population was high in all plots in May and early June, and counts showed that the numbers of feeding punctures per 20 leaves on 16th June and 1st July were 105 and

137, respectively, for 1·25 lb. DDT per acre on all but the third date, 51 and 25 for 0·75 lb. heptachlor and 26 and 6 for 0·75 lb. dieldrin on all five dates, 73 and 112 for DDT at 1·25 lb. on the first two dates and 1 lb. on the third and fifth, and 17 and 21 for 2 lb. DDT on all five. Metacide [methyl-parathion with a smaller quantity of parathion] was applied on all plots on 30th June and on the remainder of the field throughout the season.

Bobb (M. L.). **Parathion Residues on Peach Bark and Foliage.**—*J. econ. Ent.* **47** no. 1 pp. 190–191. Menasha, Wis., 1954.

Since parathion came into general use in Virginia against the plum curculio [*Conotrachelus nenuphar* (Hbst.)] on peach, the San José scale [*Quadraspidiotus perniciosus* (Comst.)] and the Forbes scale [*Q. forbesi* (Johnson)] have decreased to such an extent that dormant sprays for their control are no longer applied by many growers. The last spray against the first generation of *C. nenuphar* is generally applied by mid-May, and the crawlers of the Coccids are most numerous in late May and early June. Although parathion is known to kill Coccids in the crawler stage, it has been thought to persist for too short a time to affect those that appear 3–5 weeks after application. Parathion residues on peach foliage and bark were therefore studied in 1952–53. Sprays containing 1·5 and 4·5 lb. 15 per cent. wettable parathion per 100 U.S. gals. were applied at about 4·5 and 1·5 U.S. gals. per tree, respectively, on 1st and 16th May (sepal-fall and first cover spray) in 1952 and on 11th and 22nd April (sepal-split and sepal-fall) and 4th May (first cover spray) in 1953. Analyses of bark and leaf samples taken weekly showed that the initial residues were much greater on bark than on leaves and that residues sufficient to kill the crawlers remained for a month on the bark, as compared with less than a week on the leaves. The deposits from the concentrated sprays were rather smaller and weathered more rapidly than those from the dilute ones. Rain had no significant effect on weathering.

McCubbin (W. A.). **The Plant Quarantine Problem. A general Review of the biological, legal, administrative and public Relations of Plant Quarantines with special Reference to the United States Situation.**—*Ann. cryptog. phytopath.* **11,** 9¼ × 6 ins., 255 pp., 3 figs., 4 pp. refs. Copenhagen, E. Munksgaard, 1954. Price *Kr.* 32, $4.80 or £1 13*s.* 9*d.*

In this book, which has special reference to conditions in the United States, the author brings together much information on plant quarantines that has hitherto been scattered in specialised publications. The main subjects discussed include the biological background, social and economic relations, legal and administrative aspects, and future policies, and there are frequent references to insects as well as nematodes, fungi and bacteria.

Turnock (W. J.). **Some Aspects of the Life History and Ecology of the Pitch Nodule Maker,** *Petrova albicapitana* **(Busck) (Lepidoptera-Olethreutidae).**—*Canad. Ent.* **85** no. 7 pp. 233–243, 6 figs., 8 refs. Ottawa, 1953.

Petrova albicapitana (Busck) is a pest of potential importance in pine plantations in Manitoba and Saskatchewan. It attacks jack pine (*Pinus banksiana*), lodgepole pine (*P. contorta* var. *latifolia*) and Scots pine (*P. sylvestris*) and is widely distributed in Canada and the United States [*cf.* *R.A.E.*, A **38** 186]. Observations on its bionomics during 1948–50 in

Manitoba and Saskatchewan and in June 1950 in Minnesota showed that its life-cycle lasts two years. Eggs are laid singly at the base of the needle sheaths on the terminal shoots between early June and mid-July. The larvae feed first on the cortex of the young terminal shoots within nodules composed of pitch, silk and frass [*cf. loc. cit.*]. They overwinter in these and resume feeding in the following spring. About the beginning of June, they migrate to a crotch on the main stem or branch, where they feed on the bark, cambium and outer xylem and form another nodule, in which the second winter is passed. Pupation takes place in the following May or June after a feeding period of two or three weeks and a very short prepupal stage. The pupal stage lasts about three weeks. Two broods, usually of unequal size, occur in each locality, with adult emergence in alternate years.

The damage is caused chiefly by the larvae in their second year; distortion and weakening of the main stem was the commonest type noted in plantations, though the leader was sometimes killed. In natural stands, *P. banksiana* was more heavily attacked than *P. contorta*, but the latter is more susceptible in plantations outside its natural range than *P. banksiana* and *P. sylvestris* in adjacent plantations. In plantations, trees 1–5 ft. in height were the most severely attacked, and damage on trees over 8 ft. high was rare. Nodules were found on vigorous growth near the top of trees up to 50 ft. high, but heavy infestation appeared to depend on the presence of a succession of young susceptible plants in large numbers, and it is therefore more important to isolate new plantings from young infested plantations than from mature stands.

Mortality in Manitoba amounted to 10·5 per cent. among young larvae during October–June, 34 per cent. among feeding second-year larvae in June–November, and 39·3 per cent. among older larvae in October–June, but could not be connected with specific causes. A list is given of one Tachinid and eight Hymenoptera reared from the pupae, together with three other parasites recorded in the literature; the commonest were *Ephialtes* (*Calliephialtes*) *comstockii* Cress. and *Macrocentrus cuniculus* Walley. Parasitism varied from 2 to 16·7 per cent., and the variation is attributed to the unequal broods of the host, since the parasites appear to complete their development in one year and to attack the migrating host larvae of each brood in alternate years; their numbers are therefore limited by the size of the smaller brood.

Putman (W. L.). **Notes on the Bionomics of some Ontario Cercopids (Homoptera).**—*Canad. Ent.* **85** no. 7 pp. 244–248, 15 refs. Ottawa, 1953.

Observations on *Philaenus leucophthalmus* (L.), which has been shown to transmit peach yellows [*cf. R.A.E.*, A **28** 571], were made in the Niagara Peninsula of Ontario in connection with investigations on the bionomics of vectors of peach virus diseases. An account of the work is given, together with notes on the food-plants of several other Cercopids encountered, none of economic importance. Nymphs of *P. leucophthalmus*, which is one of the most abundant insects in the region, occur on biennial or perennial herbaceous plants or where vegetation suitable for oviposition was present in the previous year, and the adults migrate to orchards, sometimes as far as a mile from the breeding areas. In dense woods, nymphs are scarce and adults rare, though since the latter are often abundant on the terminal twigs of apple, they may occur in the tree tops. In both 1942 and 1943, over 500 nymphs were taken from an area of 10 sq. ft. in a lucerne field and another of 25 sq. ft. on a weed-grown hillside. A great concentration of adults was observed along the shores of Lake Ontario in early July 1945 and was reported to extend for 20 miles. As many as 70 were observed on a single head of rye, and the high numbers persisted for 7–8 days. As there was no evidence of breeding on a large scale in the neighbourhood, it was concluded that the adults had migrated from a district south of the Niagara Escarpment, where a large acreage of meadowland had recently been mown.

In 1942, hatching in an observation plot of lucerne was complete or almost so by 30th April, whereas in 1943 it did not begin until shortly after 13th May, when most eggs in a plot on a weed-grown south slope had already hatched. The adults matured during the last three weeks of June, were abundant during July and August, and persisted in reduced numbers until severe frost in late October or early November. The nymphs fed on at least 91 species of plants, mostly dicotyledonous perennial or biennial herbs, in 29 families, and occasionally occurred on succulent shoots of woody plants including apple, pear and cherry. Adults occurred on most of the common wild and cultivated plants and survived for at least two months in cages on peach. Nymphal feeding caused little or no damage on chrysanthemum unless it occurred near the tip of the shoot, when the plants were sometimes reduced to a rosette of distorted leaves. Adult feeding was normally unimportant, but the heavy infestation in 1945 killed buckwheat and other succulent plants and caused the leaves of peach stock to wilt, so that no further growth was made, even after control by DDT. In cage tests, feeding by ten or more adults caused the tips of the shoots of peach seedlings to wilt and sometimes affected or killed the whole plant. The feeding punctures in peach twigs penetrated intracellularly to the region of the cambium, some ending in the phloem and some in the outer xylem; copious sheath material was deposited along the path of the stylets.

NELSON (W. A.). **Observations on Hyperparasitism of the Wheat Stem Sawfly** *Cephus cinctus* **Nort. (Hymenoptera: Cephidae).**—*Canad. Ent.* **85** no. 7 pp. 249–251, 6 refs. Ottawa, 1953.

In the course of studies on the bionomics of *Bracon cephi* (Gah.), an important parasite of the wheat stem sawfly, *Cephus cinctus* Nort., in Canada [*cf. R.A.E.*, A **42** 172], observations were made on the bionomics and importance of other Hymenopterous parasites associated with this pest. *Eupelmella vesicularis* (Retz.) and *Eurytoma atripes* Gah. attacked both *C. cinctus* and *B. cephi* in Alberta and Saskatchewan, but are of little importance in controlling *C. cinctus*. In May 1946, parasitism of *C. cinctus* by these two species was 7·6 per cent. at Aylesbury, Saskatchewan, and that of *B. cephi* a month later at least 20 per cent. They were nowhere else found in economic numbers, and it is doubtful whether they materially influence parasitism of *C. cinctus* by *B. cephi*. *Merisus febriculosus* Gir. is also recorded from *B. cephi*, but was of no economic importance. *Pleurotropis utahensis* Crwf. [*cf.* **38** 186] was taken only as a primary parasite of *C. cinctus*.

HARCOURT (D. G.). **A Species of** *Tetrastichus* **new to North America.**—*Canad. Ent.* **85** no. 7 p. 251, 1 ref. Ottawa, 1953.

Adults of *Tetrastichus sokolowskii* Kurd. emerged on 31st October 1952 and 10th and 15th May 1953 from cocoons of *Plutella maculipennis* (Curt.) collected in a cabbage field at Ottawa 14–16 days earlier. This parasite had not previously been recorded from the Nearctic region, but is known from the same host in the Soviet Union and southern India [*cf. R.A.E.*, A **27** 576].

MATTHEWMAN (W. G.), PERRON (J. P.) & CASS (L. M.). **Varietal Responses of seeded Onions to the Onion Maggot.**—*Canad. Ent.* **85** no. 7 pp. 253–254, 1 ref. Ottawa, 1953.

The susceptibility of certain varieties of onion commonly cultivated in Ontario to attack by *Hylemyia antiqua* (Mg.) was investigated at Ottawa in 1945–46, when 17 varieties were under test, and 1947–49, when the number was reduced to nine. Seed was sown in plots in May, and the mortality among the seedlings caused by the larvae was noted twice weekly in June and weekly in July, after which the plants no longer succumbed to attack. Varietal differences occurred, but were not consistent. Two varieties that had been shown to support high and medium larval populations in work already noticed [*R.A.E.*, A **22** 536] showed mortality that was significantly higher than that of two others in three of the four years in which infestation was sufficiently severe for significant differences to be apparent. It is concluded that infestation at Ottawa is usually too light for varietal differences to be significant and that in years of heavy infestation they may be obscured by uneven plant establishment, which also varied considerably between varieties from year to year.

PUTNAM (L. G.). **Observations on internal Parasites (Hymenoptera: Scelionidae) of Eggs of Pest Grasshopper Species in the Prairie Provinces of Canada.**—*Canad. Ent.* **85** no. 7 pp. 255–260, 11 refs. Ottawa, 1953.

The following is largely based on the author's summary. In observations on large numbers of eggs of the grasshoppers, *Melanoplus mexicanus mexicanus* (Sauss.), *M. bivittatus* (Say) and *Camnula pellucida* (Scudd.), over a ten-year period in Manitoba, Saskatchewan and Alberta, egg-parasites of the genus *Scelio* were not observed to be of critical importance. Parasitism was highest in *M. m. mexicanus* and *M. bivittatus*, and there was some evidence that the latter was the more susceptible to attack. Eggs of *C. pellucida* were not usually parasitised, although they appeared suitable, but 10 per cent. of them were attacked in one district of Saskatchewan in 1951. The percentage parasitism of *M. m. mexicanus* reached 25 and that of *M. bivittatus* 40 in single fields or other limited sites, and under such conditions the parasites become of some local importance, probably in the declining phase of an outbreak. Nearly every instance of outstanding local or general parasitism occurred at the end of two or three consecutive years of grasshopper attack. This is the normal duration of any local outbreak in western Canada, and the percentage incidence of the parasite may therefore be dependent on host density.

It is suggested that the climate of the most southerly latitudes of western Canada, with the longest frost-free period and highest summer temperatures, may favour *Scelio*, and that elsewhere in western Canada the parasites mature too late to function at their maximum potential effectiveness; the frequent freedom from parasitism of eggs of *C. pellucida*, which are laid relatively early, may be evidence of late parasite maturity. Differences in the oviposition habits of the hosts may influence parasitism, the egg-pods of *M. bivittatus* being concentrated on limited, favourable spots and those of *M. m. mexicanus* being more scattered, though this does not apply in the case of *C. pellucida*, the egg-pods of which are also laid in restricted areas.

Salt (R. W.). **The Influence of Food on Cold Hardiness of Insects.**—*Canad. Ent.* **85** no. 7 pp. 261–269, 6 refs. Ottawa, 1953.

An account is given of experiments in which larvae of *Agrotis orthogonia* Morr. and *Ephestia kuehniella* Zell. in various stages of development, and in some cases pupae, were exposed to a temperature of −48°C. [−54·4°F.] until they reached the undercooling point, when they were removed from the low temperature. The rate of cooling was kept constant, since it affects the undercooling point [*cf. R.A.E.*, A **39** 151], and the latter was taken as a measure of cold-hardiness.

The following is largely the author's summary of the results. Feeding larvae of *A. orthogonia*, fed on wheat sprouts or forced by starvation to feed on macerated larvae of *E. kuehniella*, and feeding larvae of *E. kuehniella* fed on whole-wheat flour, which is unfreezable, were all much less cold-hardy than non-feeding premoult and freshly moulted larvae. Starvation of mid-instar larvae of both species did not result in increased cold-hardiness, possibly because the alimentary tract retained its contents. When pieces of wheat sprout were implanted into the body cavities of hardy premoult larvae of *A. orthogonia*, hardiness was decreased to the level of feeding larvae. By ligaturing such larvae and excising the implants, hardiness was restored to the original level. Dry implants of flour, glass or cork decreased undercooling of hardy larvae and pupae of both species, and the effect is attributed to their presence as foreign bodies. The action of food in decreasing cold-hardiness may also be attributed to its nature as foreign material. Moist foods may reduce cold-hardiness by direct initiation of freezing, but their effect as foreign material probably overrides such action. Digestive juices may also be considered foreign matter after they have been secreted into the alimentary tract.

It is important to distinguish between an abrupt change of cold-hardiness, resulting from a change of stage or cessation of feeding, and the gradual hardening of a non-feeding insect resulting from the operation of an ecological factor. Cold-hardiness is possessed by every insect, to a fairly fixed degree, as a property; hardening, if it occurs at all in insects, proceeds from this point. The evidence in favour of hardening in insects is at present unsatisfactory. Its relation to reduced moisture content is not settled, and much of the earlier evidence [*cf.* **15** 339; **25** 167] can be rejected because it results from a comparison of feeding and non-feeding insects.

Wallace (T.) & Martin (J. T.) Ed. **Insecticides and Colonial Agricultural Development. . . . Proceedings of the Sixth Symposium of the Colston Research Society held in the University of Bristol March 23rd–27th, 1953.**—10½ × 7½ ins., x + 169 pp., frontis., text illus. London, Butterworths sci. Publ., 1954. Price £1 10s.

It is pointed out in a preface by T. Wallace that agriculture is the mainstay of the economy of the British Colonial Territories, but that crop yields are low, because of the primitive methods on peasant holdings and the enormous losses caused by insects and diseases. The annual losses caused by insects probably represent a crop value of the order of £100 millions, and in addition to this, insects and ticks are the vectors of important diseases of livestock and man. The need for insect control is urgent, but the difficulties of the use of insecticides in communities largely composed of peasant cultivators living on mixed holdings and growing both subsistence and export crops raise many problems and progress is inevitably slow.

The introduction of new insecticides, developments in spraying equipment, and the application of sprays from aircraft have, however, opened up new possibilities, and the papers read at this symposium are designed to review the progress made in their use. They are published in full, together with reports of the discussions on them. In addition to those noticed elsewhere [*R.A.E.*, B **42** 203] they comprise: The Importance of Crop Protection to the Colonies and its Relation to Agricultural Development (pp. 1–9, 9 refs.), by W. J. Hall; Some Observations on Colonial Insecticide Research (pp. 11–21, 4 refs.), by C. B. Symes; The Control of Locusts by Insecticides (pp. 23–33, 5 maps, 8 refs.), by S. Callaway; La lutte antiacridienne dans les territoires français d'outre-mer (pp. 35–39), by G. Bouriquet; The Control of Pests of Cotton in Tropical Africa (pp. 45–52, 3 refs.), by E. O. Pearson; The Design of Insecticide Field Trials on Cotton in Uganda (pp. 53–59), by K. S. McKinlay; Insecticide Investigations on Crops in East Africa (pp. 63–74, 12 refs.), by G. Swaine; A Problem of Insecticides and Biological Control in East Africa (pp. 75–81, 2 pls., 4 figs., 6 refs.), by M. J. Way, in which it is shown that the harmful effect of the ant, *Oecophylla longinoda* (Latr.), in tending Coccids on clove and coconut in Zanzibar is outweighed by its value on coconut in destroying Coreids referred to as a species of *Theraptus* [*cf.* A **42** 123], so that its chemical control is not warranted; Crop Protection Problems in West Africa (pp. 85–88), by J. Bowden; The Rôle of Insecticides in the Agricultural Development of the British Caribbean Territories (pp. 93–101, 14 refs.), by R. G. Fennah; Losses caused by Insects in Crops during Storage and Transit (pp. 103–110), by J. W. Munro; Spraying Technique and Machinery (pp. 141–150, 2 pls., 8 refs.), by H. G. H. Kearns; and Insecticide Manufacturers' Research and Supply Problems (pp. 153–159), by E. Holmes.

JEPSON (W. F.). **A critical Review of the World Literature on the Lepidopterous Stalk Borers of tropical Graminaceous Crops.**—vi + 127 pp., 1 fig., 10 pp. refs. London, Commonw. Inst. Ent., 1954. Price 15*s*.

In this review, the literature up to the end of 1953 relating to the Lepidopterous stalk borers that attack grain crops in tropical countries is discussed in eight sections dealing, respectively, with the history of research on them; systematic characters for the identification of the adults and the general characters of the principal genera concerned; food-plants; bionomics, including the appearance of the immature stages of the various groups; the estimation of populations and assessment of damage; the relation of infestation to cultural practices; natural enemies; and control measures. Of the various tables included, one shows the principal species dealt with, other scientific names under which they have been recorded, their common names, the crops attacked, and the countries or other areas in which they occur, and another the food-plants of economic importance, with their common names, the species that attack them, the country concerned, and the main references to the literature. Recommendations for future research are made in a concluding section.

JOVER (H.). **Note préliminaire sur la biologie des Platypodidae de Basse-Côte d'Ivoire.**—*Rev. Path. vég.* **31** fasc. 2 pp. 73–81, 6 figs., 7 refs. Paris, 1952.

A list is given of 13 Platypodids that commonly attack felled trees, particularly *Turreanthus africana*, in the lower Ivory Coast. The most injurious to *T. africana* are *Doliopygus serratus* (Strohm.), *D. ve-grandis* (Samps.) and *Platypus hintzi* Schauf. Observations showed that the beetles arrive by flight in September–October, mostly in the evening when the light intensity is 300 lux or less, the temperature 24–27°C. [75·2–80·6°F.], and the relative humidity 85–95 per cent., though a few species do so earlier in the day. They attack recently felled trees, those felled on the same day in the case of *D. serratus*, *D. ve-grandis* and *P. hintzi*. In all species, the males are the first to arrive, and they bore in the bark, in the sapwood of stripped logs, or between the bark and sapwood or in the sapwood and heartwood of transverse sections. The females arrive on the second or third day, and pairing then occurs at the entrance to the gallery, after which both adults enter the gallery and the female continues the work begun by the male, who follows behind, expelling the frass or packing it into a tight cylinder that plugs the entrance. Last-stage larvae also bore in the gallery, and later excavate pupal chambers. Males are sometimes killed by the flow of resin or sap as soon as they attack a tree, and the various stages are destroyed by predacious Carabids, Clerids and Reduviids, lists of which are given, and by Brenthids and ants.

Féron (M.). **Observation sur le parasitisme de** *Ceratitis capitata* **Wied. dans le Sous marocain.**—*Rev. Path. vég.* **31** fasc. 2 pp. 99–102, 2 figs., 4 refs. Paris, 1952.

Balachowsky suggested in 1950 that the original habitat of *Ceratitis capitata* (Wied.) was in the Sous area of Morocco, where this Trypetid develops in great numbers in the fruits of the argan tree (*Argania spinosa*), a relic of tropical vegetation that covers a considerable area of the valley and extends up the mountains to the north and south. Bodenheimer considered this unlikely because of the low incidence of parasitism there, puparia collected by Vayssière in July 1930 having yielded *Opius concolor* Szépl. as the only parasite and the percentage parasitism being less than 1. The author observed that both *C. capitata* and *O. concolor* were common in the area in June 1951, the percentage parasitism among a small collection of puparia being 27·5.

Grison (P.). **La processionnaire du chêne** (*Thaumetopoea processionea* **L.**) **dans la région parisienne.**—*Rev. Path. vég.* **31** fasc. 2 pp. 103–114, 1 map. Paris, 1952.

Biliotti (E.). **Difficultés rencontrées dans la détermination des périodes d'intervention contre les processionnaires du chêne et du pin.**—*T.c.* pp. 115–120, 1 fig., 19 refs.

Attention is drawn in the first of these papers to recent outbreaks of *Thaumetopoea processionea* (L.) that have occurred on oaks in forest areas near Paris, chiefly in the valleys of the Seine and the Oise, causing defoliation of the trees and annoyance to the public. A survey was carried out in 1951, and the areas found affected are shown on a map and the status of the infestations in them outlined. The possibilities of control by means of insecticides are briefly discussed, and it is concluded that treatments against the larvae are best applied at the time of the first moult (which occurred on 4th–10th May in 1951), since the larvae are particularly susceptible to toxicants during the second instar.

It is shown in the second paper that the larvae of *T. processionea* hatch within a few days of one another and that there is a period of about 25 days between the completion of hatching and the second moult. Insecticides can be effectively applied at any time during that period without harming *Carcelia processioneae* (Ratz.), a specific parasite of *T. processionea*, since the parasite larvae do not become full-fed until the unparasitised host larvae are ready to pupate. Much the same conditions exist with regard to the control of *T. pityocampa* (Schiff.), which has recently caused damage in pine forests in southern France. Treatments applied before larvae enter the third instar will not harm the parasite, *Zenillia* (*Phryxe*) *secunda* (Br. & Berg.), but the period for effective application lasts only about two days, owing to the protracted hatching period.

BALACHOWSKY (A. S.). **Sur la présence de** *Ips acuminatus* **Gyll. (Col. Scolytoidea) dans la forêt de Rambouillet.**—*Rev. Path. vég.* **31** fasc. 2 pp. 134–135, 3 refs. Paris, 1952.

Ips acuminatus (Gylh.), which had previously been considered in France as confined to mountain regions, was observed infesting fallen pines (*Pinus sylvestris*) in the forest of Rambouillet, near Paris, in 1949–50 and 1952. Winter was probably passed in the larval stage.

RISBEC (J.). **Contribution à l'étude de** *Ceuthorrhynchus assimilis* **Payk. charançon des siliques du colza.**—*Rev. Path. vég.* **31** fasc. 3 pp. 137–174, 14 figs., 9 refs. Paris, 1952. **Le ceuthorrhynque des siliques du colza. Formule pour la détermination de la date des traitements insecticides.**—*C. R. Acad. Agric. Fr.* **38** no. 9 pp. 353–357. Paris, 1952.

HOFFMANN (A.). **À propos de** *Ceuthorrhynchus assimilis* **Payk.**—*Rev. Path. vég.* **31** fasc. 3 pp. 175–178. Paris, 1952.

RISBEC (J.). **Réponse aux observations faites par M. Hoffmann à propos de mes recherches sur le comportement du charançon du colza.**—*T.c.* pp. 179–180.

In the first paper, a detailed account is given of observations made to the north-east of Paris in March–July 1952 to determine when insecticides should be applied against *Ceuthorrhynchus assimilis* (Payk.) on winter rape. The overwintered adults appeared at the beginning of April and were numerous throughout that month, during the height of the flowering season. There was a further mass emergence in May. Males predominated until mid-May, and the females were not all sexually mature before that date. Both sexes fed on the flower buds and young pods, and oviposition occurred mainly between 25th April and 1st May and 14th and 19th May. Females deposited their eggs in the pods, preferring those that were young and tender. The larvae hatched in a week and fed on the seeds for about three weeks, after which they pupated in the soil, the pupal stage lasting 15–17 days. The first adults of this generation appeared in mid-June, and males were still almost four times as numerous as females on 7th July. The damage caused by the adults is of little importance since it occurs at a time when the pods can still be replaced, but that by the larvae is more serious, as each destroys an average of five seeds and these represent a true loss.

In field experiments, dusting with parathion, γ BHC or a mixture of the two at the usual time, when the adults were first abundant, was not fully effective, since few of the females were then ready to oviposit and further emergences and reinvasion occurred. The correct time for treatment is just before oviposition begins, and it can best be determined by noting the state of development of the ovaries of the females. The method of doing this is described, and two formulae based on the percentage of mature females and the size of the population are given for determining whether treatment will be economic in any particular case. Two treatments 8–10 days apart are usually necessary, and the finding that they should be applied later than is usually recommended is of advantage in preventing losses of pollinating insects.

The pods of spring rape develop too late for oviposition by the overwintered weevils, but they were heavily attacked by the newly emerged adults in July, when it was too late for them to be replaced, and control measures should therefore be applied from the beginning of the infestation. A comprehensive programme of treatments against all the pests of winter rape is outlined.

In the second paper, the author gives a very brief account of the observations described in the first, illustrates the use of the formulae, and suggests that Hoffmann in recording oviposition by *C. assimilis* in the buds [*R.A.E.*, A **42** 321] mistook the eggs of *Meligethes* for those of the weevil.

In the third paper, Hoffmann reaffirms that he observed oviposition by *C. assimilis* in the flower buds of cabbage and radish in 1937–38 [*loc. cit.*] and states that he found oviposition punctures, eggs and young larvae that he attributed to *C. assimilis* in the flower buds of turnip and winter rape as early as 17th April and 11th May in 1948, indicating that sexually mature adults were present at the end of March or the beginning of April, these being probably individuals that had emerged from the soil in the previous summer and fed before overwintering [*cf.* **42** 322]. However, examination of his material showed that it belonged to the form described as var. *gallorhenanus* by Solari in 1949, and in view of the biological differences noted, this probably represents a distinct species. According to collection records, it is common in the Seine valley, Alsace and the Vosges and rare in the centre and south of France.

In the fourth paper, Risbec points out that if the eggs are laid in the flower buds, the egg stage, which lasts at least a week, must be completed before these open, and the larvae would then need to feed on a great number of ovules in order to develop. However, the age of the pods after petal-fall in which he found the first larvae in the field corresponded closely with the length of the egg stage.

FEYTAUD [J.]. **Une maladie des maisons. La termitose: causes—symptomes—prévention—traitement.**—159 pp., 29 figs., 22 refs. Paris, Un. Propriété bâtie Fr., 1953. Price *Fr.* 250.

At least three species of termites are injurious to structural timbers in buildings in France, *Kalotermes* (*Calotermes*) *flavicollis* (F.) in the Mediterranean region, *Reticulitermes lucifugus* (Rossi) in the south and south-west, and *R. flavipes* (Koll.) between the Gironde and the Loire. Information is given in this booklet on the habits of these and other termites, the conditions that favour attack, structural and other measures for its prevention, the recognition of infestation and assessment of damage, the control of infestation in buildings, and the various insecticides used for this purpose.

HASSALL (K. A.). **Toxicity to the Grain Weevil of some alkyl Compounds applied as Vapours.**—*Ann. appl. Biol.* **40** no. 4 pp. 688–704, 3 graphs, 19 refs. London, 1953.

The following is based largely on the author's summary. Adults of *Calandra granaria* (L.) were fumigated with 29 organic compounds in flasks by a technique that permitted 20–30 tests to be made simultaneously. With the exception of chloroform, all the compounds were members of simple homologous series comprising alkanes, alcohols and alkyl chlorides, bromides, iodides and thiocyanates, so chosen that comparison could be made within series and, for compounds with the same alkyl groups, between them. Some of the series were known to contain substances with an anaesthetic or narcotic effect, such as is frequently attributed to substances having some type of physical action. Other series included compounds that had little or no narcotic effect, were lethal at low vapour concentrations and apparently possess chemical toxicity for some organisms. One series was expected to have some of the attributes of both physical and chemical toxicants.

The median lethal doses (LD50's) were determined, and the relation between the molar LD50's of different compounds was investigated. The variation in slope of the probit lines for compounds believed to have like and unlike modes of action was also studied. In almost all cases, the log molar LD50's decreased and the relative saturation of the vapour at the median-response level [*cf. R.A.E.*, A **37** 412] increased as the series were ascended, and when the log molar LD50's were plotted against the number of alkyl carbon atoms, the points were arranged linearly for the series with an observed narcotic effect (alkanes, chlorides and alcohols), the constant logarithmic differences being large in all except the alcohol series. However, the higher members of the two series (iodides and thiocyanates) that were presumed chemically toxic also possessed toxicities that showed a constant logarithmic difference, though a much smaller one than that characteristic of the first group, and those of the bromides showed a constant difference intermediate between these two groups. On the other hand, the lower member of the bromide, iodide and thiocyanate series had log LD50's that were not related in any obvious way. These experimental results are discussed with reference to phase distribution and chemical reactivity.

Two poisons of which the modes of action on a given organism are much alike often show parallel probit regression lines, especially if they possess similar chemical constitutions. There is, however, no reason why this should necessarily be the case, and it was found in the present investigation that compounds with an observed anaesthetic or narcotic effect often had very different probit slopes. Within most series, the slope was not greatly different except for the lower and higher members, for which it often appeared steeper than for the intermediate ones. Between series, a rough correlation often existed between probit slope and median-response vapour pressure.

Miles (M.). **Field Studies on the Influence of Weather Conditions on Egg-laying by the Cabbage Root Fly, *Erioischia brassicae* Bché. I.**—*Ann. appl. Biol.* **40** no. 4 pp. 717–725, 2 graphs, 6 refs. London, 1953.

The following is largely the author's summary of this account of investigations in south-eastern England in 1952. Oviposition by *Hylemyia* (*Erioischia*) *brassicae* (Bch.) was studied by recovering the eggs from the soil at the base of 12 of 24 cabbage plants on an observation plot. First-generation eggs were first found on 22nd April; the peak period of egg-laying lasted from 30th April to 22nd May, and the rate of oviposition declined rapidly in the last week of May. In the peak period, 5–46 eggs were laid per day per plant, with a mean of 23. The number of eggs per plant throughout the period was 258–817, with a mean of 533. Warm, sunny, showery weather induced heavy egg-laying, but cool, wet and windy weather was unfavourable.

A summer peak of egg-laying associated with the first-generation adults occurred in late June and early July. Oviposition in summer was less intense than in spring, a total of 1,298 eggs (a mean of five per day per plant) being recorded from the 12 plants between 24th June and 14th July, as compared with 5,796 during a similar period (30th April–20th May) in spring.

Observations on the numbers of flies that emerged from the 12 undisturbed alternate plants on the plot showed that the low rate of oviposition in summer was not the result of a lack of adults. Consideration of biotic and climatic factors suggested that although high temperatures and long periods of sunlight stimulated the summer flies to great activity, they were unfavourable for nectar-producing flowers. There was therefore little food to sustain the flies, which in consequence did not survive to complete oviposition.

The puparia were collected from the undisturbed plants in December in order to obtain information on the numbers of *H. brassicae* that reached maturity. It was estimated that 5–6 per cent. of the eggs gave rise to puparia; about two-thirds of the puparia gave rise to flies and one-third were parasitised. About 9 per cent. of the puparia remained viable in the soil to give rise to the following spring generation, about 90 per cent. having given rise to adults in the year in which they were formed.

From these findings, it is concluded that control measures are best applied at the beginning of the spring oviposition period, and that they are necessary in summer only under exceptional circumstances. The intensity of attack by other Anthomyiids that are active at the same times as *H. brassicae* probably varies similarly.

STOKES (B. M.). **Biological Investigations into the Validity of** *Contarinia* **Species living on the Cruciferae, with special Reference to the Swede Midge,** *Contarinia nasturtii* **(Kieffer).**—*Ann. appl. Biol.* **40** no. 4 pp. 726–741, 1 pl., 21 refs. London, 1953.

A detailed account is given of food-plant trials and rearing and cross-breeding experiments in England already briefly noticed [*R.A.E.*, A **42** 239], from which it is concluded that *Contarinia isatidis* Rübs. and *C. ruderalis* (Kieff.), which are morphologically indistinguishable, are identical with *C. nasturtii* (Kieff.) [*cf.* **38** 378]. The latter was already known to infest numerous wild and cultivated crucifers, a list of which is given, and 14 further food-plants, of which six had previously been recorded for *C. isatidis* and *C. ruderalis* and eight were established in the experiments, are added. The identity of several other species of the genus that feed on crucifers is shown to be doubtful.

GALLAY (R.). **Stations fédérales d'essais agricoles de Mont-Calme et Montagibert, Lausanne et Pully, sous-station en Valais, Conthey-Sion-Vétroz. Rapport d'activité 1951.**—*Landw. Jb. Schweiz* **66** pt. 9 pp. 915–1041, 16 figs., 5 refs. Berne, 1952.

This report contains a section (pp. 1003–1028) dealing with work on pests of vines and fruit trees in French Switzerland and the Ticino in 1951, as in previous years [*cf. R.A.E.*, A **40** 283, etc.] and also some pests of field crops. Investigations on *Melolontha melolontha* (L.) included observations in autumn on the distribution of the first-instar larvae. These showed that although population densities varied for different localities and crops, natural and artificial pastures were always the most heavily infested, followed by fields of cereals and market-garden crops, such as beet. Grassland mown only when oviposition was complete was less infested than that mown from the beginning of egg-laying, and infestation was in general halved by allowing cattle to graze on pasture land for 3–5 days in the autumn of the flight year, before the larvae had penetrated more than two inches beneath the soil surface. Owing to unfavourable weather, the numbers of *Leptinotarsa decemlineata* (Say) emerging from hibernation were low and infestation of potatoes was light though widespread. A single treatment with wettable DDT, calcium arsenate or dieldrin gave satisfactory control. Continued investigations on the Aphid vectors of potato viruses showed that populations on potato were higher in 1951 than 1948–50 [*cf.* **40** 397]. The species observed were again mainly *Myzus persicae* (Sulz.), *Macrosiphum solanifolii* (Ashm.) and *Aphis* (*Doralis*) *rhamni* Boy. *A. rhamni* was the commonest and was usually the only species present at the beginning of June.

Work was begun on the eradication of the remaining foci of *Quadraspidiotus perniciosus* (Comst.) on fruit trees in Valais and the Ticino, mainly by fumigation with hydrogen cyanide under tents [*cf.* **41** 181] or in chambers, and further food-plants of the Coccid are recorded. DDT applied twice in June at an interval of a fortnight at 0·1 per cent. in sprays and 0·2 per cent. in mists to 374 cherry trees in one area against the ovipositing females of *Rhagoletis cerasi* (L.) reduced infestation of the fruits from 57·3 per cent. in the controls to 8·7 per cent. at the edge of the treated zone and 0·4 per cent. at its centre. The winter in most of Switzerland is too rigorous to permit overwintering of pupae of *Ceratitis capitata* (Wied.), but the fly is introduced each year, causes considerable damage to peaches, apricots, apples and pears, and may persist for several seasons. Some apparently permanent centres of infestation in the south are noted.

Avion u službi zaštite bilja u Jugoslaviji 1932–1951. [The Aeroplane in the Service of Plant Protection in Yugoslavia in 1932–51.]—*Plant Prot.* no. 6–7, 180 [+ 4] pp., 20 pls., 1 fig., 3 graphs, refs. Belgrade, 1951.

The following are abstracts of papers in this symposium that deal with insect pests of plants. All have summaries in French or English

GRADOYEVIT' (M.). **The first Application of the Aviomethod in Yugoslavia in 1932,** pp. 30–41, 1 ref. [*In Serbian.*] Aeroplanes were first used for the application of insecticides in Yugoslavia in 1932, during an outbreak of *Lymantria monacha* (L.) on pine and spruce near Sarajevo. The calcium-arsenate dust applied was of poor quality and proved ineffective, and the outbreak was terminated by polyhedral disease.

ZHIVOYINOVIT' (S.). **The Rôle of Aircraft in the Control of the Gipsy Moth in 1947–50,** pp. 42–63, 7 pls., 5 refs. [*In Serbian.*] An unusually severe outbreak of *Lymantria dispar* (L.) occurred in Yugoslavia in 1947–50 and reached its peak in 1948–49, when orchards and forests over the whole of the country were affected. Apart from the usual methods of control, DDT aerosols generated by means of the exhaust gases from a Stearman PT-17 aeroplane were tested. Favourable results were obtained in preliminary work in Slovenia in 1947 and 1948, and the method was used on a large scale in forests and orchards in Bosnia, Croatia and Serbia in 1949 and in the last two areas in 1950. The aerosol was released from a 16·5 per cent. solution of DDT (Pantakan) and was applied at rates of about 1–2·4 lb. per acre, depending on the age of the larvae. Very good results were obtained in all districts, and further tests showed that

Pantakan containing 5 or 10 per cent. DDT was just as effective as the stronger solution at 2·25 lb. per acre, giving 95 per cent. mortality of the larvae. The outbreak was terminated by polyhedral disease and insect parasites.

Dobrichanin (I.). **Control of Cutworms in northern Banat in 1950,** pp. 64–74, 1 pl. [*In Serbian.*] Cutworms, mainly *Euxoa temera* (Hb.) and *Agrotis segetum* (Schiff.), have caused great losses of sugar-beet and other root-crops, forage crops, tobacco, flax, maize and sunflowers in the Province of Voyevodina and in northern Banat since 1947, and an area of about 35,000 acres was affected in Banat in 1950. In an attempt at control, aerosols released from a 16·5 per cent. solution of DDT were applied from an aeroplane at a little over 1·8 lb. per acre over about 14 sq. miles. The aeroplane flew at a height of 16–32 ft. and the width of the swathe was 26–32 ft. The treatment led to a great reduction in the larval population, and infestation was very light in 1951.

Vasić (K.). **O mogućnosti upotrebe aerosol metode u borbi protiv gusenica sovica** [On the Possibility of using the Aerosol Method in the Control of Noctuid Larvae], pp. 75–79. Details are given of an experiment in April 1950 in which a DDT aerosol applied from an aeroplane was tested against larvae of *Euxoa temera* (Hb.) in a field of lucerne in northern Banat. The aerosol was released from a 33 per cent. solution of DDT at a rate of about 1·8 lb. per acre, the aeroplane flew at a height of some 10–16 ft., and the swathe width was 32 ft. Many of the larvae were paralysed in a few hours and mortality on the following day was high.

Stankovit' (A.). **Results of the Application of the Aviomethod in the Control of Cutworms in northern Banat during the Period from 23rd April to 12th May 1950,** pp. 80–100, 1 fig., 3 graphs. [*In Serbian.*] The results in the control of cutworms by DDT aerosols recorded in the two preceding papers are discussed with reference to the age and condition of the larvae before treatment and the protection afforded by the vegetation. The rapidity with which the insecticide reached and killed the larvae was in inverse proportion to plant density, and in fields of thickly growing lucerne, in which much of the aerosol settled on the upper leaves, the reduction in population was slow. The treatment was also effective against *Phytodecta fornicata* (Brüggem.) on lucerne.

Yovanit' (M.). **Some Observations in Connection with the Control of the Larvae of Noctuids from Aeroplanes in northern Banat,** pp. 101–104. [*In Serbian.*] Although the aerosol method showed itself to be in general of great value against larvae of *Euxoa temera* (Hb.) in Yugoslavia, it was not universally successful, and the example is cited of a field of lucerne in which an aerosol released by aeroplane from a 20 per cent. DDT solution at the rate of 1·8 lb. per acre caused only 4 per cent. mortality in three days. In view of the dense growth of the lucerne, the rate of application was too low. Since females of *E. temera* mostly oviposit in fallow ground or in the vicinity of flowering weeds, on the nectar of which they feed, infestation is at first localised, and can be controlled by dusting from the ground. Aeroplanes should not be used unless large areas are involved.

Androić (M.). **Pokusno suzbijanje borovog četnjaka avio-metodom u NR Hrvatskoj 1950 godine** [Experimental Control of the Pine Processionary by the Aviomethod in Croatia in 1950], pp. 126–132, 1 ref. An outbreak of *Thaumetopoea* (*Cnethocampa*) *pityocampa* (Schiff.) occurred on pines on the Adriatic coast of Yugoslavia in 1946–50, and the effectiveness against the overwintered larvae of an aerosol released from a 16·5 per cent. solution of DDT (Pantakan) applied from an aeroplane at 2·5 and 2·35 lb. per acre was tested in the island of Cres in March 1950. The results were unsatisfactory, as the larvae proved resistant to the insecticide and many of them had already entered the soil for pupation. It was observed that in years with a dry autumn followed by a mild winter the larvae reached maturity much earlier than has been recorded in the literature, fifth-instar individuals being present as early as January. Under such conditions, the chief damage to the trees is caused in autumn, and control would probably be more effective then and less injurious to insect parasites.

Bleiweis (S.). **Pojav pinijevega sprevodnega prelca v Slovenskem Primorju in borba proti njemu** [The Appearance of the Pine Processionary in the Maritime Zone of Slovenia and its Control], pp. 133–140. *Thaumetopoea* (*Cnethocampa*) *pityocampa* (Schiff.) has been established in mixed stands of pines in the region of Kras since afforestation began in 1886. Its bionomics and the chief outbreaks that have occurred in the area are reviewed. Insecticides were first applied against it in 1948, when a DDT dust gave promising results, and in 1950 an aerosol released from a 16·5 per cent. solution of DDT (Pantakan) applied in March from an aeroplane at 2·6 lb. per acre was tested over nearly 6 sq. miles of heavily infested pine forest at altitudes of up to nearly 2,000 ft. Owing to mild weather, many of the larvae had entered the soil for pupation as early as February. The treatment was on the whole effective as 60–70 per cent. of the larvae were killed, but it is concluded that control would be better applied in September or October, when the larvae are feeding and more susceptible to the poison.

Tominić (A.). **Upotreba aviometode u suzbijanju maslinove muhe kod nas** [The Use of the Aviomethod in the Control of the Olive Fly in our Country], pp. 141–152, 5 refs. In field experiments carried out in June–July 1951 in the district of Dubrovnik and the adjacent islands, an aerosol stated to contain 16 per cent. DDT was applied from an aeroplane at an average rate of 1·8 lb. per acre to about 2 sq. miles of olive groves against *Dacus oleae* (Gmel.). The aeroplane used, an Aero-2 of Yugoslav manufacture, was not of a suitable type for the mountainous country concerned, and the treatment was completely ineffective. There was some evidence that the insecticide was affected by the high temperature prevailing.

Bogavats (M.). **The Results of an Experiment on the Control of the Mulberry Moth by the Aviomethod,** pp. 158–161. [*In Serbian.*] By 1951, *Hyphantria cunea* (Dru.) had spread considerably in northern Yugoslavia and was recorded as far west as Zagreb [*cf. R.A.E.*, A **41** 298]. It was very numerous near Subotica in that year, and observations on its bionomics showed that emergence of the adults of the first generation reached its peak between 16th and 24th July. Oviposition and hatching were very protracted, and maximum infestation by second-generation larvae occurred about 5th September, when mulberry, plum, apple, quince and pear trees were heavily attacked. Serious injury was also caused to shade trees over an area of some 58 acres in the park of a tourist resort. In the latter area, the trees were too high for destruction of the larval nests, and a proprietary nicotine spray and a 5 per cent. BHC dust proved unsatisfactory. A DDT aerosol was therefore tested in September, when most of the larvae were in the sixth instar and some had already pupated. The aerosol was applied by aeroplane from a 20 per cent. solution of DDT at about 4·25 lb. per acre to the park and several orchards. Only about half the insecticide distributed was actually deposited on the experimental area, but paralysed larvae, chiefly those in the second and third instars, were observed on the ground after 20 minutes and mortality of all instars was complete in eight days.

Marmontov (D.). **The Destruction of the common Pine Sawfly in Mal'en by the Aviomethod,** pp. 168–173. [*In Serbian.*] An outbreak of *Diprion pini* (L.) occurred in 1951 in a forest of pines (*Pinus nigra*) about 80 years old in the mountainous district of Mal'en (Serbia), where this sawfly had not previously been observed. As the forest is of value for soil conservation and as a source of resin, control from an aeroplane was attempted. Over 1,000 acres were treated between 20th June and 3rd July with a 16 per cent. solution of DDT applied as an aerosol at an average rate of 3·37 lb. per acre, but as the Aero-2 aeroplane used was not suitable for the type of country and the operation was not well carried out, the outbreak was not checked. Treatment was therefore resumed with a PT-17 aeroplane from 21st to 25th August against larvae of the second generation, the solution being applied at an average rate of 3·15 lb. per acre to 865 acres of heavily infested forest. Control was complete, and this is attributed not only to technical improvements but also to the fact that treatment was carried out when the larvae had just hatched and were very susceptible to the insecticide.

SHCHERBINOVSKIĬ (N. S.). **The Desert Locust** *Schistocerca*. **The Problem of protecting the southern Territories of the USSR from Invasion by Swarms of** *Schistocerca*. [*In Russian.*]—9 × 6 ins., 416 pp., 142 figs. (7 fldg.), 6 pp. refs. Moscow, Gos. Izd. sel'skokh. Lit., 1952. Price 10 *rub.* 15 *kop.*

This book is based on the literature and investigations by the author in 1929 and 1942–44 in Persia and neighbouring countries on the biology and ecology of *Schistocerca gregaria* (Forsk.). Particular attention is paid to the conditions that regulate mass breeding and migrations of this locust, with a view to the forecasting of invasions of Soviet territory such as those that occurred in 1929–30, when swarms of *S. gregaria* migrated from Persia and Afghanistan into Transcaucasia and Soviet Central Asia [*cf. R.A.E.*, A **23** 581, etc.].

The author believes that the periodicity of the outbreaks of *S. gregaria* is related to the cyclic changes in solar activity that occur over average periods of 11 years and induce regular fluctuations of climate [*cf.* **17** 632]. About two years after solar activity reaches its peak, there is an increase in precipitation in India, Pakistan and Arabia. This creates favourable conditions for the development of the locust and results in a sharp increase in numbers and a temporary widening of its area of distribution. Thus, a new cycle of mass multiplication begins. Each outbreak lasts about 5–6 years, in the course of which the locust spreads northwards and may cross the boundaries of the Soviet Union [*cf.* **42** 363]. These regulating conditions are the foundation on which forecasts can be based.

The systematic position of *S. gregaria* is briefly discussed, descriptions are given of the adults of the solitary and the gregarious form and of the immature stages of the latter, and the literature on the locust, particularly that published in Russia, is reviewed. Some 170 pages are devoted to the characterisation of the permanent and temporary habitats of *S. gregaria*, and its area of occurrence is divided into four zones, which are shown on a map. They comprise the regions of permanent habitation containing the basic outbreak centres, in which *S. gregaria* is present chiefly in the solitary and transitional forms; the zone of temporary centres, which originate in years of mass increase, when the locusts migrate beyond the boundaries of the permanent habitats, and in which one or two generations are produced before the locusts die out as a result of unfavourable weather; a further zone that is invaded by swarms for not longer than six months, usually from April to the end of September, in which only one generation is produced before migration to summer-monsoon regions; and the peripheral areas into which swarms penetrate occasionally as a result of normal migration or of wind carriage. The third zone includes the southern parts of Soviet Central Asia, and the fourth the south of Transcaucasia. The climate, landscape, soil and vegetation of various parts of Africa, Arabia, India, Pakistan and Persia, and the seasonal development, migrations and permanent foci of *S. gregaria* are discussed at some length. From an analysis of conditions prevailing in southern Persia and his own observations, the author concludes that no permanent outbreak centres of *S. gregaria* exist there [*cf.* **21** 159; **23** 583]. Swarms that arise in India, Pakistan and Arabia during the monsoon enter southern Persia from October to the end of February in years of outbreaks, but the locust is absent in years of intercyclic depression. The outbreaks in India, Pakistan, Persia and Arabia in 1940–45 are discussed, and the routes of swarm movement are shown on maps.

The food-plants of *S. gregaria* are reviewed, mainly from the point of view of the effect of different botanical groups on the development, physiology and maturation of the hoppers and adults, and the plants on which they were observed to feed in Central Asia, Persia, Arabia, India and Pakistan are enumerated, with notes on preferences. The diseases, parasites and predators of *S. gregaria* recorded by Russian investigators are also reviewed, and the organisation of information services on the abundance and movements of *Schistocerca* in the parts of Persia from which swarms may invade the Soviet Union and the organisation of control in Persia are discussed.

In conclusion, a brief survey is made of the current cycle of outbreaks of *Schistocerca* in southern Persia. Swarms entered this area in October–November 1949 from India and Pakistan, where mass increase was favoured by excessive rainfall, and more did so in 1950 from the Oman coast of Arabia.

BHATNAGAR (S. P.). **Descriptions of new and Records of known Chalcidoidea (Parasitic Hymenoptera) from India.**—*Indian J. agric. Sci.* **21** (1951) pt. 2 pp. 155–178, 64 figs., 8 refs. Delhi [1952].

The new species described include *Torymus chaubattiensis*, *Pachycrepoideus indicus* and *Coccidencyrtus kumaoensis*, from *Anuraphis padi* (L.) (*Aphis helichrysi* (Kalt.)) [*cf.* also next abstract], *Solindenia vermai* from larvae of *Epilachna* sp., *Encyrtus siddiqii* from *Eulecanium coryli* (L.), *Euplectrus spodopterae* from *Spodoptera mauritia* (Boisd.), *E. maternus* from larvae of *Othreis materna* (L.) and *O. fullonia* (Cl.), and *Tetrastichus lasiopterae* from larvae of *Lasioptera falcata* Felt, all in India.

LAL (K. B.) & SIDDIQI (Z. A.). **Biology of the Peach Leaf Curling Aphis on the Kamaun Hills.**—*Indian J. Ent.* **14** (1952) pt. 3 pp. 191–196, 16 refs. New Delhi, 1953.

Anuraphis padi (L.) (*helichrysi* (Kalt.)) is a serious pest of peach and plum in the Kamaun Hills and similar areas in Uttar Pradesh, India, causing the leaves to curl and the fruits to be shed prematurely. At altitudes above 5,000 ft., it infests the trees from November to May and passes the rest of the year on *Erigeron canadensis*, its one summer food-plant there. At the beginning of November, alate viviparous females migrate from *E. canadensis* to peach and plum, where they give rise to oviparae, and these are fertilised by males that usually develop on *Erigeron* and migrate to the trees at the end of November. Eggs are laid singly at the base of the buds in mid-December and hatch at the end of January, and

3–4 generations of parthenogenetic viviparae, of which the last are alate, are produced between late February or early March and the end of May. The alates migrate to *Erigeron*, on which 4–5 generations of apterous viviparae develop during the summer, though some alates may appear intermittently and migrate to other *Erigeron* plants. At lower altitudes, the summer food-plant is *Ageratum conyzoides*, no winter eggs are laid, and the adults overwinter and resume reproduction in the first week of January.

The Aphid is attacked by several parasites and ten predacious Coccinellids, which are listed. The parasites include three recently described by Bhatnagar [see preceding abstract], *Pachyneuron ferrierei* Mani and *Aphelinus gossypii* Timb. *Coccinella septempunctata* L. is the commonest of the predators, its population rising to about 100 per tree in April.

A fungus, *Taphrina deformans*, also causes leaf-curl on peach, but the damage is usually confined to trees raised from seedlings and affected leaves are pink in colour, whereas those injured by the Aphid are yellow-green.

RAMACHANDRAN (S.). **A Note on the Identity of the Cerambycid Borer of Oranges in South India.**—*Indian J. Ent.* **14** (1952) pt. 3 p. 214, 2 refs. New Delhi, 1953.

The Cerambycid of the genus *Chelidonium* that bores in orange in Mysore and Coorg has hitherto been regarded as *C. cinctum* (Guér.) [*cf. R.A.E.*, A **17** 167], but the species concerned in the Wynaad district of Mysore, where damage has recently increased, was found to be *C. argentatum* (Dalm.). Since the uplands of Coorg are contiguous with this district, it is probable that *C. argentatum* also occurs there. The bionomics of the two species are similar.

VENKATRAMAN (T. V.) & GOVIL (M. L.). **Some Effects of low Temperature on the Biology of** *Trichogramma evanescens minutum* **Riley, in Mass Breeding.**—*Indian J. Ent.* **14** (1952) pt. 3 pp. 215–227, 7 figs., 11 refs. New Delhi, 1953.

Large stocks of *Trichogramma minutum* Ril. are reared in the laboratory in India for release against *Chilotraea infuscatella* (Sn.) (*Argyria sticticraspis* Hmps.) and *Emmalocera depressella* (Swinh.) on sugar-cane, and since the adult parasites and parasitised host-eggs are stored at low temperature before distribution, the effect of such exposure on the parasites reared on eggs of *Corcyra cephalonica* (Staint.) was investigated. Preliminary tests with parasitised eggs showed that the prepupal stage of the parasite, which is reached after four days, was not affected adversely by refrigeration for up to 25 days, and was the most suitable one for cold storage. The observations were therefore carried out on adults reared from prepupae that had been exposed in the eggs to a temperature of about 12°C. [53·6°F.] at about 85 per cent. relative humidity for periods of 5–25 days, and subsequently kept at 25°C. [77°F.] and 65 per cent. relative humidity. The percentage of adult parasites that emerged, the survival period of the adults, and the number of eggs deposited by the females all decreased as the period of refrigeration increased, but were seriously affected only by exposures exceeding about 15 days. Adults that did not pair and females that did not oviposit survived for longer than those that did. The sex ratio was not affected by exposure to the low temperature for less than about ten days, after which the percentage of females increased. When newly emerged adults were kept at the low temperature, the survival period was markedly reduced by exposure for two days and halved by exposure for five, and fecundity was reduced by exposure for more than three days.

Basha (J. M. G.). **Experiments on the Control of the Fruit Borers of Jujube** (*Zizyphus* **spp.**), *Carpomyia vesuviana* **Costa and** *Meridarchis scyrodes* **Meyr. in South India.**—*Indian J. Ent.* **14** (1952) pt. 3 pp. 229–238, 5 figs., 4 refs. New Delhi, 1953.

Zizyphus jujuba is widely cultivated in the Kurnool district of Madras, but the Trypetid, *Carpomyia vesuviana* Costa, has since 1939 become increasingly injurious to the fruits, causing severe losses. Other pests of the tree include the Carposinid, *Meridarchis scyrodes* Meyr., which also attacks the fruits, *Tarucus theophrastus* (F.), *Thiacidas postica* Wlk., *Myllocerus transmarinus* (Hbst.), *Cleonus faunus* (Ol.) (*Xanthochelus superciliosus* (Gylh.)), and *Dacus correctus* (Bez.), of which the first is the most important. On a few trees at Coimbatore, infestation by *Carpomyia* ranged from 1·4 to 44·4 per cent. during 1949–50 and was heaviest during July–September. Near Kurnool, infestation reached 68 per cent. in October 1950 and 72–77 per cent. in November–December. In the latter district, four or five overlapping generations were observed during the season. The first major emergence of adults usually follows showers in July, when the trees are beginning to flower, and oviposition begins in August–September, the females each depositing up to 22 eggs singly or in groups of 2–4 in the rind of the fruits. The larvae hatch in 2–3 days and feed in the pulp for 15–20 days, as many as 12 having been recorded in a single fruit. They pupate in the soil at depths of 2–3 ins. or, rarely, in the fallen fruits. The pupal stage may be short, when it lasts 12 days or less, or long, when it occupies up to 305 days. Infestation by *Meridarchis* ranged from 5·3 to 39·2 per cent. at Coimbatore during July–August and from 6·7 to 12·3 per cent. near Kurnool. The larvae also feed in the pulp, producing large quantities of frass. Infestation by the two species results in a reduction in total yield, since many infested fruits drop, and a serious deterioration in quality.

The methods hitherto recommended for control of *C. vesuviana* comprised the use of baits or bait-sprays or the destruction of the pupae by raking the soil beneath the trees [*cf. R.A.E.*, A **30** 559], but as these are unsatisfactory, sprays of BHC or DDT were tested. In 1949, suspensions of 0·1 or 0·2 per cent. BHC or DDT and an emulsified solution of 0·08 or 0·16 per cent. DDT were applied to randomised plots in a block of trees seven times at three-weekly intervals between early August and early December. BHC gave good control of both insects and did not injure the leaves or fruits. DDT was rather less effective, especially in the emulsified solution. Infestation was low throughout the block, although high in neighbouring plantings, and this is attributed to a repellent effect of the insecticides, especially BHC. In 1950, four applications of 0·05 per cent. BHC or 0·1 per cent. DDT were made in two plantings at three-weekly intervals from 14th September, when the fruits were set, until a month before harvest. In the DDT plot, the percentage of fruits infested by *C. vesuviana* was 20·7 at the end of October and 16·3 in December and that by *M. scyrodes* 4·7 and 8; the final infestation in the controls was 74·3 and 7·7 per cent., respectively. In the BHC plot, the percentage infestation by *C. vesuviana* increased from 8·7 to 16·7 and that by *M. scyrodes* from 2·7 to 6·7, whereas the final infestation in the controls was 72 and

11·7 per cent., respectively. The percentage increases in yield were 92 for BHC and 77 for DDT. There was some tainting of the fruits by BHC, and the DDT treatment proved the cheaper.

Bhatia (D. R.) & Sikka (H. L.). **The Singhara Beetle** (*Galerucella birmanica* **Jacoby—Chrysomelidae) in Delhi Area and its Control.**—*Indian J. Ent.* **14** (1952) pt. 3 pp. 239–242, 5 refs. New Delhi, 1953.

Water-nut (*Trapa bispinosa*) growing in ponds and a lake near Delhi was severely injured in 1948 and 1949 by *Galerucella birmanica* (Jac.), the adults and especially the larvae of which feed on the upper epidermis of the floating leaves, retarding growth and reducing the size of the crop [*cf.* *R.A.E.*, A **23** 102]. The integument of the fruits at the surface of the water was also sometimes attacked, which caused the edible parts to rot. The annual cycle of this Galerucid is imperfectly known.

Adults could not be found during winter in cracks in the sides of reservoirs used for the cultivation of the crop [*cf.* **23** 103] or on weeds growing by the lake. In mid-February 1950, however, some were present on *Trapa* leaves remaining in the lake from the previous year. Pairing was observed on 20th February, and recently laid eggs in clusters of 4–19 were found a week later. On 11th March, adults were present on floating plants of *Azolla* spp. that were blown about by the wind, and by the end of March they were fairly numerous on *Trapa* in nursery ditches, where eggs hatched in early April. In the ponds, the young leaves of nursery stock were damaged by adults in early March, when clusters of up to 24 eggs were found.

In tests on control, a dust containing 5 per cent. BHC gave complete mortality of adults, eggs and pupae and almost complete control of larvae in 72 hours in October 1948, with no deleterious effect on the crop, and in larger trials in October–November 1949 this dust, alone and with talc (1:1), another containing 5 per cent. BHC, and two of 10 per cent. DDT, all at about 15 lb. per acre, gave complete control of all stages, the adults dying in 24 hours and the larvae in 48.

Pruthi (H. S.) & Bhatia (D. R.). **Trial of aerial Methods of Control of the Desert Locust** (*Schistocerca gregaria* **Forsk.) in India.**—*Indian J. Ent.* **14** (1952) pt. 3 pp. 243–256, 5 figs., 2 refs. New Delhi, 1953.

Pruthi (H. S.), Bhatia (D. R.) & Mathur (C. B.). **Preliminary Observations on Aldrin as anti-locust Insecticide.**—*T.c.* pp. 273–296, 3 figs., 3 refs.

In the second paper, an account is given of laboratory and field investigations in India in 1951 on the effectiveness of aldrin against *Schistocerca gregaria* (Forsk.). Aldrin was used in the form of a stock solution containing 57 per cent. active ingredient and 43 per cent. chlorinated hydrocarbon solvents, and in the laboratory tests this was diluted in kerosene and atomised upwards into an inverted cylinder 8 ins. in diameter and 17½ ins. high. The locusts (all in phase *gregaria*) were exposed either to the falling spray or to sand treated with it. Not all the spray reached the bottom and it was calculated from a preliminary test that when the solution was diluted 1:50 and 1 cc. was applied, 0·2 mg. of the original solution was deposited per sq. inch.

When the solution was diluted 1:50 or 1:100 and the amount of spray applied was 0·5 or 1 cc., adult locusts exposed in the cylinder for 1–5 minutes all died in 19–66 hours, and when greater dilutions, ranging down to 1:300, were used, with a dosage of 0·5 cc. and an exposure period of two minutes, mortality began in 22 hours and was complete or nearly so in about 70 hours. Feeding ceased after 4–8 hours. Similar exposure to the greatest dilution for two minutes at a dosage of 0·25 cc. caused the first locust to die in 45 hours and killed them all in 96 hours. Fifth-instar hoppers were almost all killed in five days by exposure for two minutes to dilutions of 1:100–200 at a dosage of 0·5 cc., though some completed their development normally, and at 1:300 this treatment gave complete mortality of younger hoppers in 78 hours.

In the tests with the sand, fifth-instar hoppers confined for 10–30 minutes on the deposits from a dilution of 1:300 at 0·5 cc. all subsequently died, though mortality did not begin for two days. The effect was also slow when the exposure was increased to 1–2 hours, mortality not being complete for a fortnight. Younger hoppers were more susceptible, all those in the third instar dying in 116 hours after contact for 60–90 minutes with the deposits from 1 cc. spray at 1:300. Mortality of adults exposed for 24 hours on sand treated with 0·5 cc. spray at 1:300 was complete in 140 hours when the deposits were fresh and in ten days when they were three days old; it did not exceed 80 per cent. in ten days when they were four days old, and older deposits were ineffective. Third-instar hoppers allowed to feed on cucumber leaves sprayed on one side in the cylinder with 0·5 cc. spray at a dilution of 1:100 succumbed within 17 hours, indicating that application as a stomach poison shows promise.

The field trials were carried out in northern Rajasthan, where the aldrin solution was diluted to about 1:20 in kerosene and applied by Piper Cub aircraft to 12 resting or ovipositing swarms at a rate of about 5·25 oz. aldrin per acre during August. Dead and dying locusts were subsequently found in the sprayed areas and at distances of up to ten miles from one of them. Of 68 locusts collected from a sprayed swarm and caged in the laboratory, 50 died within 48 hours and hoppers that hatched in the sprayed area after 13 days all died. Tests were made against hopper bands in August–September, when the stock solution was diluted to about 1:32 in kerosene and applied from aircraft or from the ground or emulsified in water and applied from the ground. The dosage in each case was about 4 oz. aldrin per acre. The emulsified solution and the solution applied from the ground gave complete mortality in two and 11 hours, respectively, and the solution applied from the air in general in 12–72 hours, though all the hoppers died in two hours in one test and in nine hours in another. In two tests, hopper bands that passed over the sprayed area 14 days after treatment were killed by the residues. No rain fell during the trials.

The results of the aerial spraying are also given in the first paper, with a description of the aircraft employed, an account of the organisation of the work, and discussions of the comparative cost of spraying from the air and from the ground and of the value of aircraft in reconnaissance and control. It is concluded that aircraft could not replace any part of the ground organisation, since the locusts, especially settled swarms and hoppers, could not as a rule be detected from them and a ground staff was therefore required to discover and mark the infested area. Furthermore, swarms sometimes moved away during the interval between their discovery and the arrival of the aircraft. The use of aircraft is considered to be of value only in cases of sudden emergency, in cultivated areas, or in forest.

Appanna (M.). *Microbracon hebetor* **Say: Possibilities of its Mass-production and large-scale Utilization against Insect Pests of Field Crops.**—*Indian J. Ent.* **14** (1952) pt. 3 pp. 263–267, 2 figs., 7 refs. New Delhi, 1953.

Bracon (Microbracon) hebetor Say gives fairly effective control of *Corcyra cephalonica* (Staint.) in stored rice, sorghum and oil-seeds in Mysore, and following the appearance of large numbers of the parasite in a laboratory culture of *C. cephalonica*, it was decided to maintain a stock for use against certain Lepidopterous pests of field crops [*cf. R.A.E.*, A **32** 304]. In addition to hosts already recorded from India [**32** 304–305], the species on which it was reared in the laboratory included the sorghum caterpillar, *Stenachroia elongella* Hmps., the potato moth, *Gnorimoschema* (*Phthorimoea*) *operculella* (Zell.), and the sugar-cane borer, *Chilotraea infuscatella* (Sn.) (*Argyria sticticraspis* (Hmps.)).

Large-scale rearing on *Corcyra* was hampered by *Pediculoides ventricosus* (Newp.), which attacked the host larvae, and by the webs spun by the latter when fully fed, in which the parasites became entangled. Brushing the host larvae, dipping them in water at 30°C. [86°F.] for 30 seconds and starving them for two hours before exposure to the parasites led to some improvement, but it was not possible to carry out all three measures on a large scale. In the method finally adopted, the *Corcyra* larvae were reared on sterilised sorghum and exposed to the parasites when full-fed in a special breeding cage. This comprised a rectangular metal box, measuring 18 × 9 × 6 ins., in the top of which were two sliding glass panels to permit observation and cleaning, these being covered with paper when the cage was in use, and a central panel with two holes for the insertion of a thermometer and a wick soaked in honey and another for the introduction of the parasites and hosts. In the sides of the box were 18 holes, each fitted with a metal sleeve surrounding a conical funnel that projected outward into a glass tube of which the open end fitted into the sleeve. The holes were kept plugged until fair numbers of parasite cocoons were present. On emerging, the adult parasites entered the tubes and were removed when needed. The maximum number of larvae introduced for parasitism was 400 and the maximum number of parasites collected at one time was 2,761.

It was found that *B. hebetor* could be reared on a large scale throughout the year within temperature and humidity ranges of 22–27°C. [71·6–80·6°F.] and 60–80 per cent., respectively. Fully grown host larvae were preferred for oviposition, but before depositing many eggs, the females punctured all the larvae present, irrespective of size. The life-cycle averaged 9 days during hot months and 16 during the cooler ones, and the size of the adults produced varied with the size of the host and the number of parasites that developed on it. The sexes were almost equal in numbers, but at 80 per cent. relative humidity, females were more numerous than males; more parasites emerged at that humidity than at 40 per cent.

COMMON (I. F. B.). **The Australian Species of *Heliothis* (Lepidoptera: Noctuidae) and their Pest Status.**—*Aust. J. Zool.* **1** no. 3 pp. 319–344, 1 pl., 4 figs., 51 refs. Melbourne, 1953.

Heliothis armigera (Hb.) has usually been regarded as world-wide in distribution, but information on its ecology in different parts of its reputed range was conflicting and the discrepancies could not readily be explained by differences of climate or food-plants. Since it has been recorded throughout Australia but appears to vary in local importance, specimens from each State and from other countries were examined, with special reference to the genitalia, and compared with the types or topotypical specimens of most of the species that Hampson considered to be identical with *H. armigera* or *H. assulta* Gn., which also occurs in Australia. As a result, the synonymy of *assulta* adopted by Hampson was confirmed and *Heliothis* (*Thalpophila*) *rubrescens* (Wlk.), an Australian species that he considered identical with *H. armigera*, was shown to be distinct. Specimens of *H. armigera* from Europe, Queensland, New South Wales, New

Zealand, Fiji, Africa and India were found to be identical, but distinct from specimens from Canada and the United States referred to *H. armigera*. It is therefore concluded that *H. armigera* does not occur in North America. The American species is differentiated from *H. armigera* in both sexes by characters of the genitalia, figures of which are given; the name that should be used for it is probably *H. umbrosa* Grote [*cf. R.A.E.*, A **16** 678–679].

The species of *Heliothis* recognised as present in Australia are *H. punctigera* Wllgr., *H. armigera*, *H. assulta* and *H. rubrescens*. Descriptions of the adults and descriptions and figures of the genitalia of both sexes of all four are given, with details of their distribution, and a discussion of their economic status in Australia based on the literature.

H. punctigera, which has been misidentified as *H. armigera*, occurs in every State and appears to be solely responsible for damage in Tasmania, Victoria, South Australia, Western Australia, the Northern Territory, and inland areas of Queensland and New South Wales, including the Capital Territory. In the last two States, it attacks tomato, flax, lucerne, peas, cabbage, deciduous fruits and tobacco, and it is also recorded from ornamental plants and the weeds, *Trianthema portulacastrum* and *Hypericum perforatum*. *Heliothis armigera* occurs in Queensland, New South Wales, the Capital Territory and South Australia and is probably more important than *H. punctigera* in the coastal areas of the first two States and in the Callide Valley of Queensland. The more important crops attacked by it are maize, tomato, cotton, lucerne, tobacco, cabbage and beans; it is also recorded from sorghum and *T. portulacastrum* in Australia and has been reared from flax in New Zealand. It is injurious during the warmer months of each year, whereas *H. punctigera* is usually more important in spring and causes serious damage only occasionally. *H. assulta* occurs in Queensland [**8** 62], Western Australia and the Northern Territory. It is a major pest of tobacco in Sumatra [**29** 319], but has not been recognised as a pest of this crop in Queensland, though it possibly attacks it in the northern part of the State. *H. rubrescens* occurs commonly over most of Australia, but is not a pest and its native food-plant is unknown.

SWEZEY (O. H.). **Forest Entomology in Hawaii. An annotated Check-list of the Insect Faunas of the various Components of the Hawaiian Forests.**—*Spec. Publ. Bishop Mus.* no. 44, ix + 266 pp., 32 figs., 16 pp. refs. Honolulu, 1954. Price $4.

This list of the insects associated with the trees and other plant components of natural forest in Hawaii is arranged systematically under food-plants. Notes on local distribution and the part of the plant attacked are given for most species, with records of other food-plants and parasites for some.

PAPERS NOTICED BY TITLE ONLY.

MIDDLEKAUFF (W. W.). **A new Species of web-spinning Sawfly** [*Cephalcia marginata*, sp.n.] **feeding upon Pines** [in Canada and the United States] (**Hymenoptera, Pamphiliidae**).—*Pan-Pacif. Ent.* **29** no. 3 pp. 133–134. San Francisco, Cal., 1953.

MUKERJI (S.). **On a new Species of Scelionidae,** *Scelio oviphagus* **sp. nov.** (**Serphoidea = Proctotrypoidea: Hymenoptera**) **parasitic on Eggs of** *Hieroglyphus nigrorepletus* **I. Bol., in Ajmer** (**India**).—*Indian J. Ent.* **14** (1952) pt. 3 pp. 203–213, 8 figs., 1 ref. New Delhi, 1953.

HAARLØV (N.) & PETERSEN (B. B.). **Temperaturmålinger i bark og ved af sitkagran** (*Picea sitchensis*) **med saerlig henblik på temperaturen i gangsystemer af** *Hylesinus* (*Dendroctonus*) *micans.* [Measurements of Temperature in Bark and Wood of Sitka Spruce (*P. sitchensis*) with special Reference to Temperature in Galleries of *Dendroctonus* (*Hylesinus*) *micans.*]—*Forstl. Forsøgsv. Danm.* **21** pp. [3 +] 43–91, 18 figs., 28 refs. Copenhagen, 1952. (With a Summary in English.)

GUNTHER (F. A.), KOLBEZEN (M. J.) & BLINN (R. C.). **A preliminary Report on the colorimetric Detection of Dieldrin.**—*J. econ. Ent.* **47** no. 1 pp. 185–186. Menasha, Wis., 1954.

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